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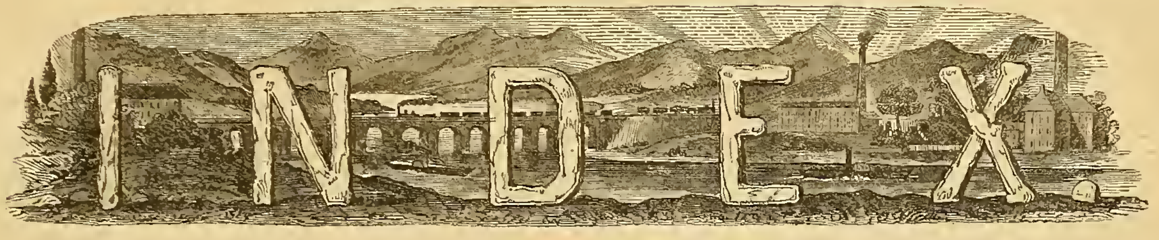

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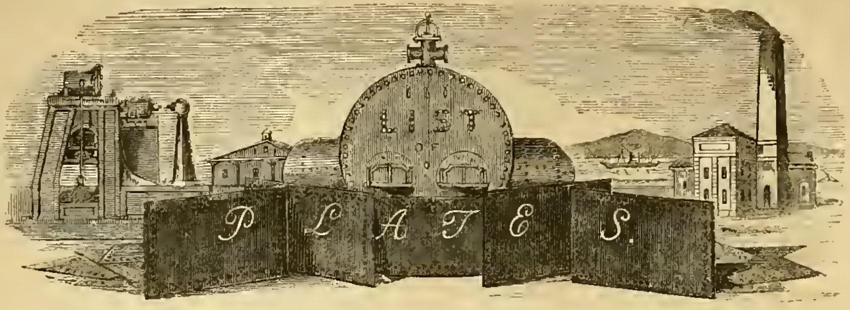

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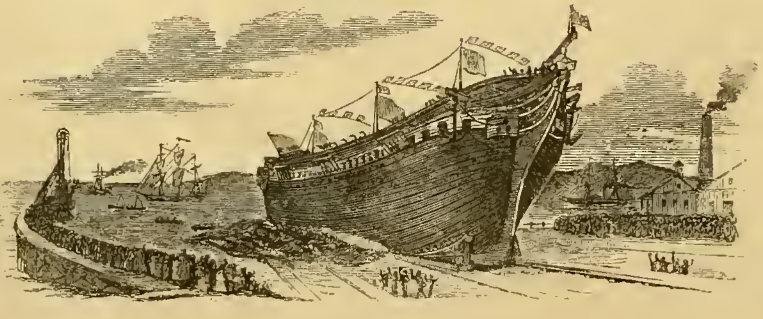

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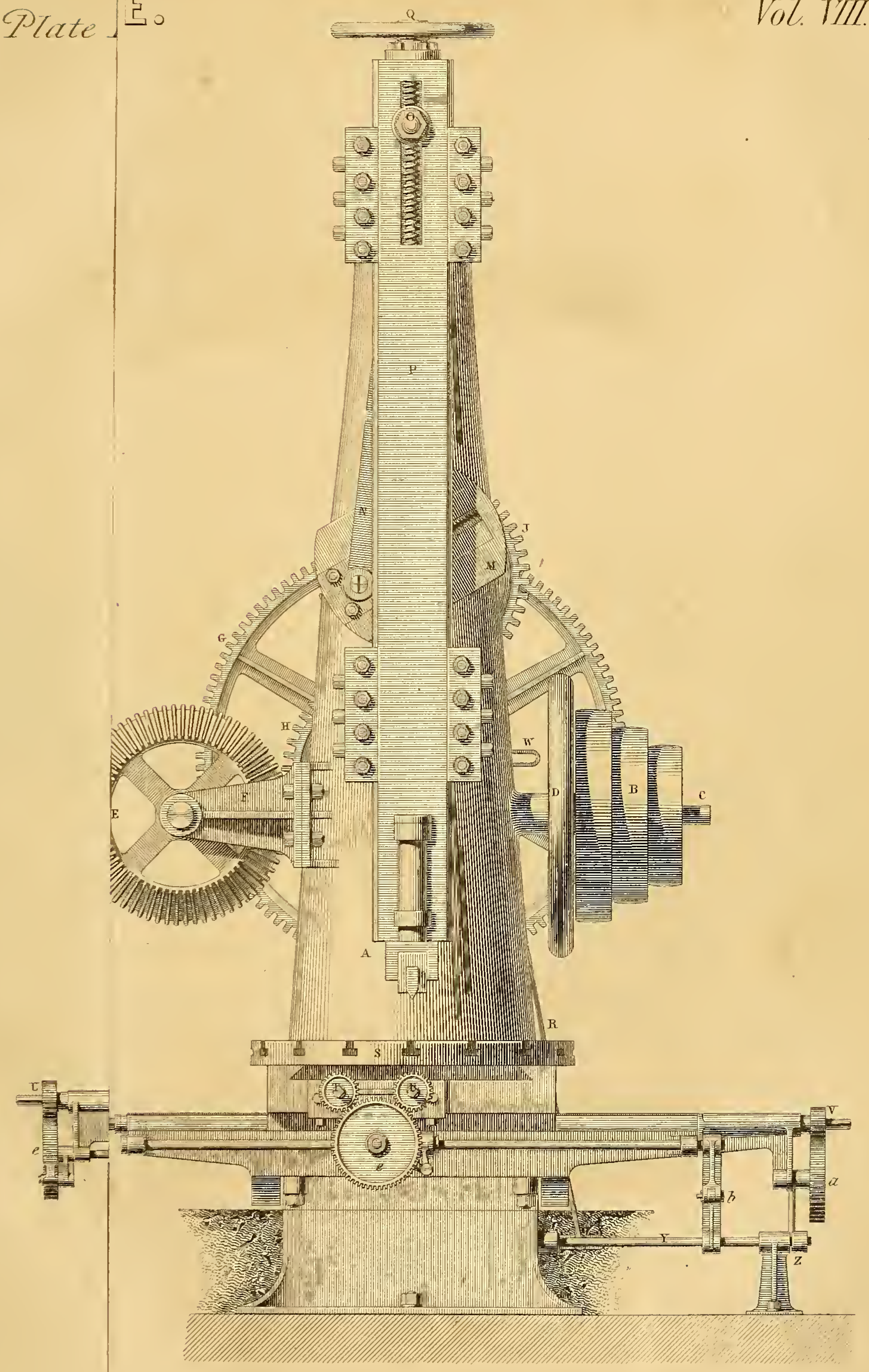

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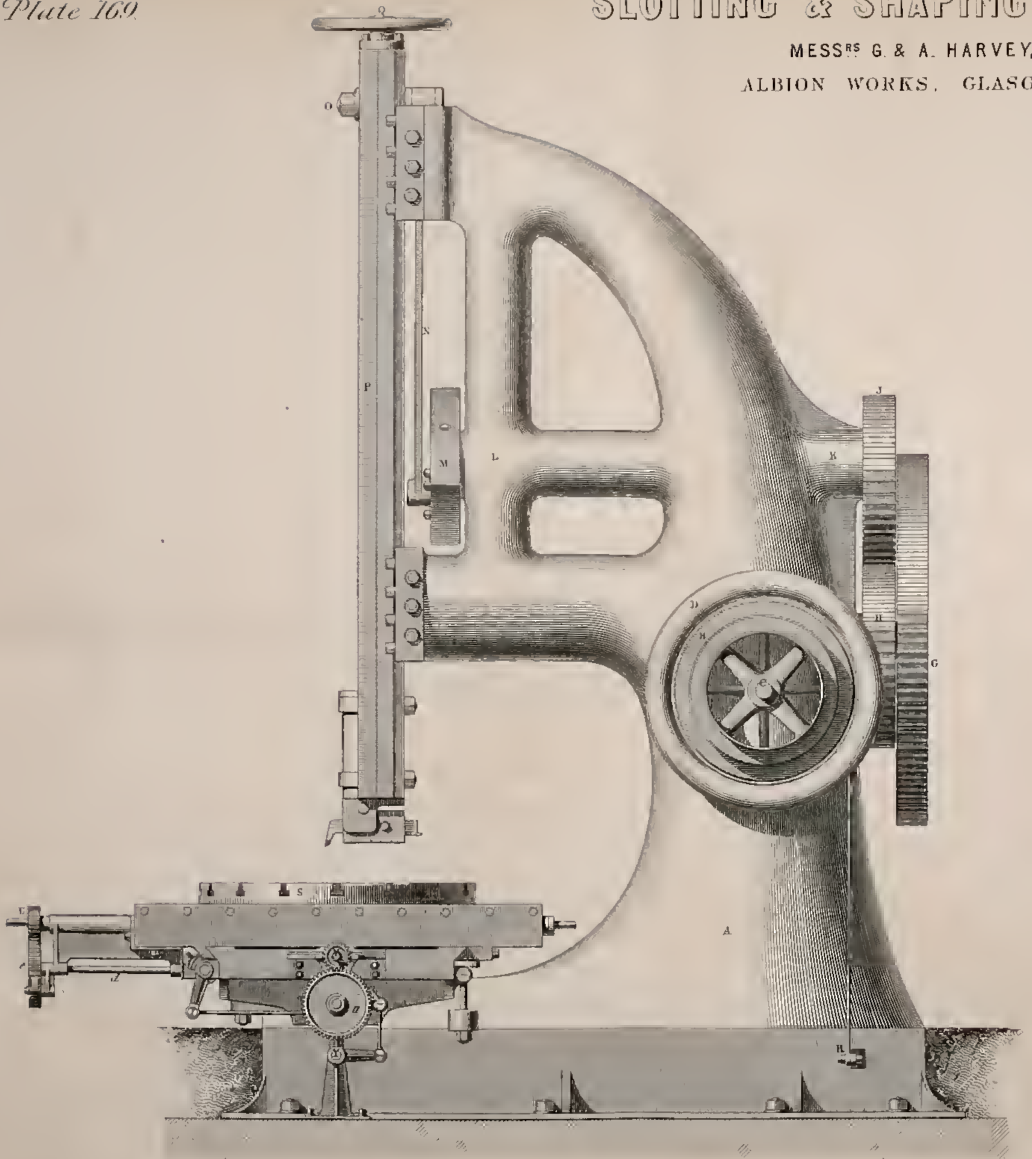

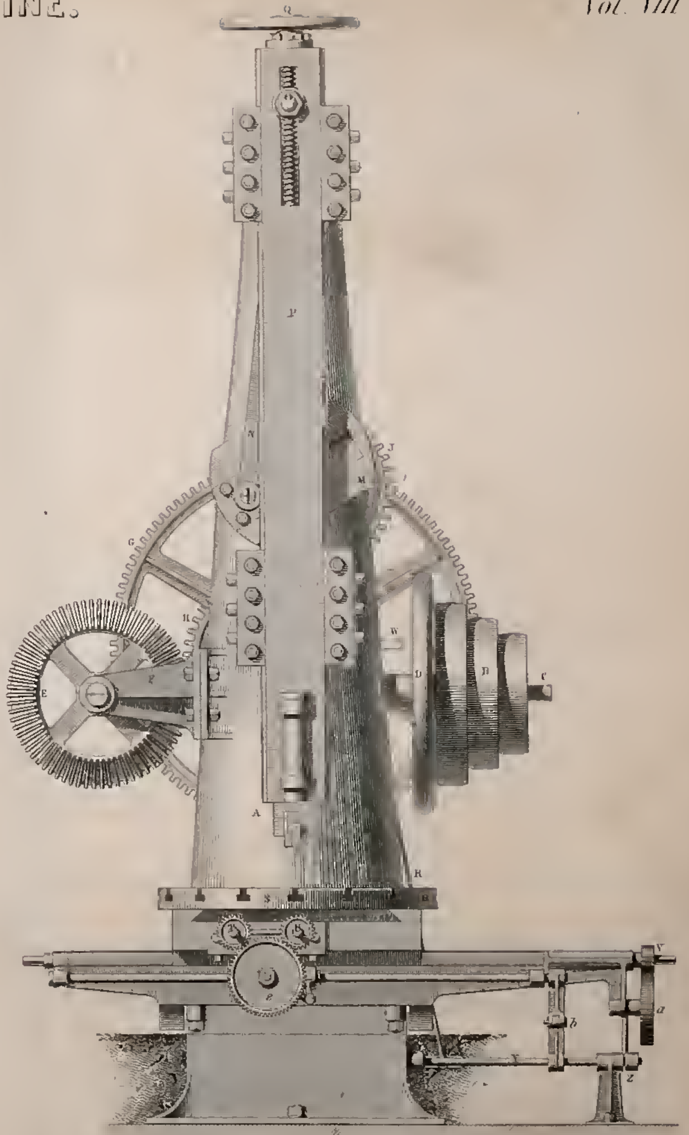

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JOURNAL.

THE COMING FRENCH EXHIBITION.

To Every one who has at all considered the subject, the display about to be made at Paris appears of deep importance—indeed, its general importance cannot be exaggerated. That memory must be weak which is not even now greatly impressed with the grandeur and beauty which in Hyde Park almost overcame the senses, and took the mind and feelings by storm four years ago. Few are the inhabitants of the British islands who were able to revive the pleasurable associations of 1851, in the great building erected in the Western World; perhaps Europeans generally were to be seen comparatively few in number, in the commercial metropolis of the United States. The failure of the New York Exhibition, in many respects, is to be ascribed to this, while the great and awful highway between the old and new civilizations, was doubtless the principal cause of the attraction not being able to command so many visitors. From the geographical position of the States, the actual results might easily have been predicted, particularly as the American Exhibition followed so rapidly on the heels of the original. These things require very great facilities for ingress and egress. In old Europe, with its hundred contributing peoples, these facilities abounded. They did not so abound in America; and, if they had so abounded, the century of contributors there were reduced, if we may use the word, to *nil*. The rapidity with which that occasion presented itself, had, we apprehend, little to do with its short-comings. For such exhibitions cannot be too frequent, provided the spirit of the mechanic and manufacturer keep pace with that of the inventor, or the would-be inventor, for whom they are as mines of treasure. There they, indeed, may all go and imp their wings, if they have any, and there do the public expect to find them. The French have experienced the value of a return, at very short periods, of even their simple national collections, and they now take up the one given by England in a manner worthy of their acknowledged excellence in all the sciences and arts. Great exhibitions have not yet been as plentiful as blackberries. Their extent will render them, for a long time to come, too novel to weary the student of their stores. To the most industriously observant, they will always present a something new—new facts and new combinations. It were well if all nations were conscious how it behoved them to keep up, to their utmost, this character of these shows. This consciousness has evidently come upon our friendly ally; and we cannot be surprised at this, when we consider the importance which it is to her in particular. It is scarcely hyperbolical to say, that her nation is a race of artists. Go into her capital—go into her provinces—go into the houses of the least as well as the greatest in her land, and you will see the artist everywhere. Their proverbial politeness is but the involuntary oozing out of the artistic instinct. Age exhibits it; childhood exhibits it; and seen, as we have seen it often there, it is a loveable thing. It lies at the root of their freshness and gaiety, but even these yield to it when the two cannot stand together.

It is a maxim with many, that "of two evils choose the least." Our neighbours are beginning to show, that "of two good things," it is a principle with them to "choose the greater." Who could have surmised that the gay and the volatile *Français* could so easily have parted with one-half of his dearly-beloved Champs Elysées, as he is this moment doing? and that a magnificent building of novel construction would be allowed to usurp any, much less so great a part, of the locality devoted to the liveliness of the Parisian afternoon? Yet so it is. Even sovereignty itself makes some sacrifice. For the view from the windows and balconies of the Tuileries towards the Barrière de l'Etoile, cannot be said to be any way improved by the enormous Palais d'Industrie, now erected.

Nor can we omit to notice the remarkable circumstances under which this huge pile of building appears in France. All honour to the remarkable Personage who sways the destinies of her empire!—the Restorer of the dynasty of Bonaparte, and of the Idées Napoleoniennes! If the conception and carrying out of such works and their completion, in the midst of wars and rumours of wars—the works of quietness and peace, pursued in the midst of discord and confusion—be any evidence of a ruler's desire to please, and of a nation's desire to be pleased, a nation's gratitude for this and many better things, will surely do more to confirm the present Emperor on his throne, than all the measures still lingering in the general mind of the first great one of his name.

There is one essential difference between the Great English Structure of 1851 and the present one of 1855. The former was intended to be, and became, in fact, merely temporary. The latter is destined to be permanent. Nothing more marks the true understanding of such things among the French people than this fact. They have felt the value of displays of less extent. Their hope and performances have risen with every successive display. And now they are no longer satisfied with the tent of the desert, to be erected and struck as the wind and rain of fortune may decide, but they must have a magnificent edifice, capable of weathering all storms of all seasons. They have it, too, assuredly. For nothing, even in their elegant capital, stands out more grandly and beautifully than the building within which the arts and manufactures of the world—Russia not excluded—are now being rapidly accumulated. When the trumpet first sounded in 1851, the general mind became overwhelmed by the bare realization of the one great idea. It is now sobered down. Misty imagination has become the handmaid of reason, panoplied with its wings of discovery and invention. It is a very wise maxim among lawyers, that nothing is invented perfect. The first invention is but as one "gradus ad Parnassum"—a first step, it may be tottering and trembling, but a step still. It may, therefore, readily be surmised that the coming Exhibition will not fall short of the splendour of our own of glorious memory. We rejoice, indeed, to believe that it will far exceed its prototype in many very essential respects. It is but proper that it should do so; although, even now, with much information of what may be expected, it is difficult to conceive how this is possible. The truth is, we have scarcely recovered from the spell of the potion administered four years ago. There is every reason, however, to believe that this will be the case. London and New York will be eclipsed. This is the current report; but we shall shortly be able to judge for ourselves.

The intended addition of "Paintings" is a prime feature of improvement. If report speak correctly, there will be some works exhibited, both by French and English artists, that will become famous, although the Committee of Management, as regards the United Kingdom, in this respect, has not, in our opinion, been established upon the proper foundation. Again, rich and varied as were the contributions from our Eastern empire to the evanescent glass-case in Hyde Park, it has been intimated that the Indian authorities have supplied many defects, then noticed, in their supplies towards the benefit and gratification of the artist and manufacturer on the present occasion. There is also a rumour that Her Majesty has volunteered to expose, to the gaze of the public eye, the Koh-i-noor, as re-cut. Besides, what with the many exhibitions which have lately been, and the improvements of the patent laws in all civilized countries, a stimulus has recently been given to invention and manufacture, some great results of which, it is reasonable to conclude, will be forthcoming on the banks of the Seine. "It might have done for 1851, but it wont do now," has, probably, been the expression in more cases than the one that we know of, when a manufacturer has proposed to send something to the coming show. We recollect that, at our own Exhibition, there were several contributors, whom we personally knew, who sent different articles, and withdrew them as quickly and as quietly as they could when they discovered their inferiority. It is a prime characteristic of all these sights to raise the standard of taste, and elevate the principle of judgment; and there cannot be any doubt but that the world's fair at hand will demonstrate this in all its departments. We must not, however, expect too much from it. If we are right in what we have written above, we cannot do so. Our anticipations will necessarily fall short of the reality, as whose did not on the first occasion? It was not the many miles of mere handicraft that formed the attraction; it was the heavenly, peaceful spirit which pervaded every nook and corner (for even the warlike instruments were at rest) that diffused around its charms. If we were sensitive to this at that time, the recent distressing experiences of war are not likely to make us more obtuse at present, and they will not. But, with all such natural sentiment which may be re-aroused, we shall do well to remember that the Exhibition is ours to make the most of. We are gratified in learning that our own position, as a somewhat artistic, and pre-eminently a manufacturing and mechanical people, will be adequately represented; and it will be our duty to watch well the position of other nations. Comparisons were, on the former occasion, made, greatly, and in most instances deservedly, to our prejudice. We were made to learn a new lesson. We promise to ourselves better things: may the result fulfil it!

It is very naturally expected that the French metropolis will, in the course of the season, be honoured with the presence of almost all the reigning powers in Europe. From the commencement to the close of the Exhibition, it will no doubt be the cynosure of all neighbouring eyes. The willingness of Paris to entertain its visitors is, however, greater than its capacity; and, should the rush be unevenly distributed, we apprehend considerable inconvenience will accrue to multitudes. It will behove all to be a little wary when, under these circumstances, they fulfil their present intention of paying a visit to the Champs Elysées. However this may be, there cannot be two opinions as to the duty of our leading manufacturers to organize squadrons of their intelligent workmen to proceed to take advantage of this other great study to be opened to them. They might, moreover, stimulate the observation of their *employés* by offering premiums for best accounts of specific classes of objects. Where manufacturers themselves cannot, or will not, undertake such organization, it will be their duty, at least, to enable those in their employ who may desire it to visit Paris. It is the duty even of artificers themselves to organize bands of fellow-labourers to proceed there. The probability of ready and very cheap access thither will, no doubt, put it into the minds of many, for once in their lives, to leave old England's shores and tread the near but still too foreign land. We would propose that the Society of Arts should organize a special committee, to promote the wishes and administer to the comfort of such little troöps of harmless warriors who may be induced to display a little knight-errantry in this respect. The Society possesses great facilities for this purpose, and we shall be glad to hear that our suggestion has been adopted.

The Emperor of the French has right royally held out the palm of welcome, and has already honoured his coming visitors in a remarkable manner. New public embellishments have been made in the capital, and palaces commenced two centuries ago are being rapidly completed, for the express purpose of gratifying the friends of his subjects among surrounding nations. The picturesque costumes of the peasants and others from the French Departments alone will, doubtless, be a continuing novel feature during the whole period of the Exhibition. There are greater facilities for getting to Paris than to London, as regards the lower classes of the European continent, and we should not be surprised if the prospect of seeing such assemblages as we have referred to, do not induce many people to go to Paris who would not otherwise think of leaving home. But, to the majority, Paris itself will be a sight. It is now unquestionably the most splendid capital of the world, and both ancient and modern times have written upon its walls and causeways legends of thrilling interest. Who that can go and has not been to Paris, will not go there this year? Who that has been there many times, will not presently visit it once more?

PATENT OFFICE GALLERY OF INVENTORS' PORTRAITS.

A suggestion was some time ago made by Prince Albert, with the view of aiding in the perpetuation of the names and achievements of inventors; and that suggestion has now found a practical echo in the Great Seal Patent Office, under the auspices of Mr. B. Woodcroft. The plan thus pointed out in high quarters was, that a collection of portraits of inventors, of all classes, should be established and kept up, as a means of preserving memorials of genius, living and departed, and as an incentive to inventive efforts on the part of the members of the age in which we live.

Mr. Woodcroft, to whom we owe a large amount of the real improvement in matters existing between Government and inventors, has been the first to seize upon the idea; and he has made a fair beginning, in getting together, in his apartments in the Great Seal Patent Office, the following portraits of "inventors, discoverers, and introducers of useful arts:"—

Sir Richard Arkwright. (Engraving by R. Smith, from painting by Jos. Wright.) Inventor of improvements in preparation and spinning machines. Patents Nos. 931 (1769), 1111 (1775).

Roger Bacon, Franciscan monk, author of upwards of eighty scientific and philosophical treatises, and the reputed inventor of gunpowder, of the air-pump, the camera-obscura, the diving-bell, and of the application (as in modern times) of paddle-wheels to boats. (Engraving from a picture at Knowle, 1736.)

Robert Barker. (Engraving by Flight, from painting by C. Allingham.) Inventor of panoramas. Patent No. 1612 (1787).

John Baskerville. (Half-length.) Celebrated printer, and inventor of machinery for marking, flat-grinding, and moulding thin metal plates. (Patent No. 582 (1742).

William Bauer. (Lithograph by Joseph Bauer.) Inventor of apparatus for effecting submarine explosions.

Brigadier-General Sir Samuel Bentham, K.S.G. (Miniature portrait, "presented by Lady Bentham, for the Gallery of Portraits of Inventors.") Author of essays on various subjects, inventor of machinery for working in wood, metal, &c., &c., and of improvements in and in means for laying substructures of bridges, piers, and similar erections. Patents Nos. 1838 (1791), 1947 (1793), 1951 (1793), 2035 (1795), 3429 (1811), 3544 (1812).

George Birkbeck, M.D., F.A.S., M.A.S., &c., founder of mechanics' institutes. (Engraving by H. Dawe, from painting by Lane.)

Dr. Joseph Black, chemical philosopher, discoverer of the cause of causticity, and propounder of the theory of latent heat. (Engraving by Heath, from painting by Raeburn.) [illegible]

John George Bodmer. (Miniature.) Inventor of improvements in preparation and spinning machines, in steam-engines, locomotion, and the propulsion of vessels, in machinery for working metals, &c., &c. Patents Nos. 5016 (1824), 6616 (1834), 6617 (1834), 6841 (1835), 7388, (1837), 7837 (1838), 7881 (1838), 8070 (1839), 8579 (1840), 8912 (1841), 8981 (1841), 9279 (1842), 9547 (1842), 9702 (1843), 9899 (1843), 10,243 (1844), 12,641 (1849).

Matthew Boulton. (Engraving by A. Cardon, from painting by Sir Wm. Beechey, R.A.) Founder of the celebrated works at Soho, near Handsworth; inventor of improvements in the art of inlaying steel, of coining machinery, of improvements in steam-engines, &c., &c. Patents Nos. 1757 (1790), 2207 (1797).

The Same. (Engraving by Reynolds, from painting by Breda.)

James Brindley. (Engraving by Conde.) Constructor of the Duke of Bridgewater's canal, inventor of a steam-mining and draining pump, &c. Patent No. 730 (1758).

Rev. Edmund Cartwright, D.D. (Engraving by Thomson.) Inventor of the steam or power loom, of improvements in preparation and spinning machines, in steam-engines, &c., &c., for which various improvements he received, in 1809, a parliamentary grant of £10,000. Patents Nos. 1470 (1785), 1565 (1786), 1616 (1787), 1676 (1788), 1696 (1789), 1747 (1790), 1787 (1790), 1876 (1792), 2046 (1795), 2194 (1797), 2202 (1797), 2471 (1801).

William Caxton. (Engraving by Bagford.) Critic, translator, and earliest English typographer.

Thomas Clark, LL.D., professor of chemistry in Marischal College, University of Aberdeen. (Three-quarter portrait by Alexander Craig.) Inventor of chemical apparatus for the production of chlorine and the manufacture of sulphuric acid, of processes for glazing and enamelling metals, for purifying and softening water, &c. Patents Nos. 6488 (1833), 7440 (1837), 8080 (1839), 8666 (1840), 8875 (1841), 10,328 (1844).

Captain the Right Hon. Lord Thomas Cochrane (Admiral the Earl of Dundonald), K.B., &c. (Engraving by H. R. Cook, from painting by Strochling.) Chemical philosopher, inventor of improvements in street lamps and lighting, in locomotion, in the propulsion of vessels, &c., &c. Patents Nos. 3657 (1813), 3772 (1813), 4217 (1818), 4241 (1818), 4253 (1818), 5256 (1825), 6018 (1830), 6036 (1830), 6530 (1833), 6923 (1835), 9593 (1843), 10,497 (1845), 12,064 (1848), 13,698 (1851).

Columbus propounding to the Prior of the Franciscan Convent of Santa Maria de Rabida his theory of a New World. (Chromolithograph by Vincent Brooks, from the original by G. Cattermole.)

Sir Francis Crane, last Lay Chancellor of the Order of the Garter, and Master of Tapestry to King James I., in whose reign he began the tapestry manufacture at Mortlake, in Surrey, where copies were woven of the seven cartoons of Raffaelle. (Engraving.)

Samuel Crompton. (Engraving by S. W. Reynolds, from painting by Allingham.) Inventor of the "mule" spinning machine, for which he received a parliamentary grant of £5000.

John Dalton, D.C.L., F.R.SS.L. & E., Member of the Institute of France, &c. (Engraving by J. Stephenson.) Eminent chemical philosopher, propounder of the "atomic" theory, and author of numerous philosophical papers and treatises.

Nicholas Dubois Dechemant, surgeon. (Engraving by Conde, from painting by Charles Dufretay.) Inventor of mineral artificial teeth.

Rev. John Theophilus Desaguliers, LL.D., F.R.S. (Engraving by P. Pelham, from painting by H. Hying.) Author of lectures, and of papers published in the "Transactions of the Royal Society," translator of Gravesande's "Mathematical Elements of Natural Philosophy," and inventor of a mode of applying steam to drying, baking, brewing, and other processes. Patent No. 430 (1720).

John Dollond. (Engraving by J. Poscelwhite, from original in the Royal Observatory, Greenwich.) Eminent optician, inventor of improvements in quadrants, telescopes, and other optical instruments. (Patents Nos. 721 (1758), 752 (1760).

Peter Dollond. (Engraving by J. Thomson, from original by J. Hoppner. R.A.) Eminent optician, inventor of improvements in quadrants, sectants, &c. Patent No. 1017 (1772).

William Fairbairn. (Engraving by T. O. Barlow, from painting by P. Westcott. A gift of the original painting has been made, but has not yet been received.) Inventor of improvements in the steam-engine, in the construction of metal ships, boats, iron beams for bridges, &c., in the propulsion of vessels, and in hoisting machines. Patents Nos. 9072 (1841), 9409 (1842), 10,095 (1844), 10,166 (1844), 11,401 (1846), 13,317 (1850).

Benjamin Goodfellow. (Original painting by S. Sidley.) Inventor of improvements in metallic pistons, in steam-engines, boilers, &c., &c. Patents Nos. 7912 (1838), 12,762 (1849), 14,023 (1852).

Henry Greathead, of South Shields. (Engraving by Ridley.) Inventor of a life-boat, for which he received a parliamentary grant of £1850.

Rev. John Harmar. (Drawing in chalk, by J. R. Smith, and bearing the following inscription:—"This, the original likeness of the late Rev. John Harmar, has by his family been presented to Bennet Woodcroft, towards the formation of a National Gallery of the Portraits of Inventors, and is the first gift for that interesting and valuable object. 6th Dec., 1853.") Inventor of improvements in machinery for raising and shearing woollen cloth. Patents Nos. 1595 (1787), 1982 (1794).

Dr. John Harrison. (Engraving by Tassaert, from painting by T. King.) Eminent mathematician, inventor of the compound pendulum, and of chronometers for determining longitude at sea; also, author of a work describing such instruments.

Harvey demonstrating to Charles I. his theory of the Circulation of the Blood. (Engraving by H. Lemon from the original by R. Hannah.)

Rowland Hill, Esq., Secretary to the Postmaster-General. (Engraving by W. O. Geller, from painting by A. Wivell, jun.) Projector of the "penny postage," and inventor of improvements in printing machines. Patent No. 6762 (1835).

Nicholas Hilliard, principal painter of small portraits and embosser in gold to King James I. (Engraving from miniature at Penshurst, painted by himself. Patent No. 2 (1617).

The Same. (Engraved by Chambers, from painting at Penshurst.)

John Kay. (Small portrait, in oil.) Inventor of improvements in preparation and spinning machines, in looms, in drying-kilns, of a wind-pump, &c. &c. Patents Nos. 515 (1730), 542 (1733), 561 (1738), 612 (1745).

William Lee, A.M., inventor of the stocking-frame. (Engraving from picture by Balderston, formerly in the Stocking-Weavers' Hall, Redcross-street, London.) This painting contains the portrait of a man in collegiate costume, in the act of pointing to an iron stocking-frame, and addressing a woman, who is knitting with needles by hand. It bore the following inscription:—"In the year 1589, the ingenious William Lee, A.M., of St. John's College, Cambridge, devised this profitable art for stockings (but, being despised, went to France), yet of iron to himself, but to us and to others of gold; in memory of whom this is here painted." As this interesting work of art seems to have been parted with by the Company at a period of pecuniary embarrassment, and is now probably in private hands, the accompanying particulars, chiefly supplied to Mr. Woodcroft by individuals officially connected with the Framework-Knitters' Almshouses in London, are published, in the hope of assisting its present possessor to identify the subject, and at the same time induce the restoration of so valuable an original to some worthy public position:—"On the inside of the cover of the second book of the Company's records are two lists, dated (16) 87, of plate, pictures, &c., then belonging to, and in the possession of, the Company, in one of which lists is an item, 'Mr. Lee's Picture, by Balderston.' In 1708, Hatton's book was published, which mentions this picture. From 1732, the Company's books show no more meetings at their hall, which probably the Company let, and removed its plate, pictures, &c., to a tavern. There are no minutes of any court having been held from 1732 till 1745, from which date the Company appears to have held its courts at the White Hart Tavern, Bishopsgate-street. In 1755, a bond was entered into by the then landlord of the 'Dog Tavern, Garlick Hill,' for securing the 'plate, &c.,' belonging to the Company, and deposited with him for its use. No copy of the bond or its schedule, however, is made in the books. In 1759, the hall was leased to Mr. Seward, a brewer: if not previously, Mr. Lee's picture must then have been removed. In July, 1761, the Company removed its 'plate, colors, furniture, &c.' to the Ship Tavern, Threadneedle-street, where the courts were held with tolerable regularity for about nine years, after which various taverns seem to have been used; and subsequently to 1772, the Company met frequently at the New England Coffee House, and again at the White Hart Tavern, Bishopsgate-street. But no further mention is made of 'Mr. Lee's Picture, by Balderston,' which it is probable was included either in the 'plate, &c.,' of 1755, or the 'plate, colors, furniture, &c.,' of 1761; for there is in the Company's possession a copperplate for court summonses, dated 1777, engraved with a similar heading to the above; and as it is not improbable that the picture was in the Company's possession in 1761, it is also most probable that the engraving, which tallies with Hatton's description on the plate, dated 1777, was taken from Mr. Lee's picture. There is no entry subsequent to 1770, by which the existence of the picture can be inferred, or its fate determined. The above engraving seems to be a close imitation of the plate dated 1777." Additional statement:—"Can only add, that it is my opinion that it was, together with other pictures, taken by 'Mr. Robinson, of Threadneedle-street,' about 1773, either to wipe off a debt due to him by the Company, or as a security for its repayment. Mr. Robinson was an influential member of the Court of Framework-Knitters, and resided in Threadneedle-street. Courts were sometimes held at his house, and from time to time he lent the Company money, as appears by their books now extant."

Justin Liebig, LL.D., eminent chemical philosopher. (Drawing in chalk by Samuel Lawrence.) See Patent in the name of Muspratt, No. 18,616 (1845).

John Mercer. (Half-length, by Alexander Craig; presented to B. Woodcroft by John Graham, Esq., of Staleybridge.) Inventor of improvements in the production of dyes, colours, and other chemical agents, and of processes for their application to yarns and textile materials. Patents Nos. 8183 (1839), 9517 (1842), 10,757 (1845), 11,190 (1846), 11,252 (1846), 11,742 (1847), 12,807 (1849), 13,296 (1850), 14,024 (1852).

George Frederick Muntz, Esq., M.P. (Lithograph by Fairland, from drawing by A. Wivell.) Inventor of improvements in melting and other furnaces, in the manufacture of steam-boilers, and in machinery for the manufacture of metal tubes, of metal sheathing for ships, and bolts and other ships' fastenings. Patents Nos. 3989 (1816), 6325 (1832), 6347 (1832), 6495 (1833), 11,410 (1846), 13,461 (1851).

Sir Hugh Myddelton, Bart. (Engraving by Vertue, from painting by Jannson.) Projector of the New River Works, and inventor of machinery for winning and draining lands. Patent No. 19 (1621).

The Same. (Engraving by Walker, from painting by Jannson.)

Thomas Paine, political writer. (Engraving by Sharp, from painting by Romney.) Inventor of a method of constructing iron bridges, and other vaulted or arched structures requiring extended span. Patent No. 1667 (1788).

Dionysius Papin, M.D., F.R.S., professor of mathematics. (Half-length.) Author of scientific treatises, and inventor of apparatus, called " Digester, for softening bones."

Sir Robert Peele, First Baronet. (Engraving by Dickinson, from painting by James Northcote, R.A.) Inventor of improvements in preparation and spinning machines. Patent No. 1212 (1779).

Richard Prosser. (Painting by A. Wivell.) Inventor of lap-welded iron tubes for the conveyance of water and gas, of machinery for their manufacture, and for the manufacture of nails, screws, pipes, bars, &c. &c.; of the application of pulverized clay to the production of buttons, tiles, pottery-ware, tesseræ, &c.; and of improvements in furnaces, stoves, cooking apparatus, steam-boilers, &c. &c. Patents Nos. 6132 (1831), 6775 (1835), 7969 (1839), 8064 (1839), 8454 (1840), 8548 (1840), 9707 (1843), 10,649 (1845), 13,035 (1850), 13,238 (1850).

James Ransome. (Lithograph by Hanharts, from drawing by T. H. Maguire.) Inventor of improvements in railways, and in agricultural implements. Patents Nos. 4038 (1816), 4513 (1820), 8847 (1841).

Robert Ransome. (Lithograph by Hanharts, from drawing by T. H. Maguire.) Inventor of improvements in the manufacture of agricultural implements and machines. Patents Nos. 3139 (1808), 4573 (1820), 6918 (1835), 9842 (1843).

Richard Roberts. (Drawing by J. Stephenson.) Inventor of improvements in steam-engines, in locomotion, in preparation and spinning machines, in looms for weaving, in corn-mills, in machinery for punching and working metals, in time-keepers, in gauges for fluids, and in boats, ships, &c. &c. Patents Nos. 4726 (1822), 5138 (1825), 5949 (1830), 6258 (1832), 6526 (1834), 6690 (1834), 8012 (1839), 10,150 (1844), 11,607 (1847), 11,608 (1847), 11,747 (1847), 12,207 (1848), 12,948 (1850), 13,779 (1851), 14,130 (1852).

Benjamin (Thompson) Count Rumford, LL.D., Vice-President of the Royal Society, &c., &c., author of essays and papers on political economy, philosophy, and mechanics, and projector of various plans for improving the arts and conveniences of domestic life. (Engraving.)

His Highness Prince Rupert, K.G., &c. (Engraved by Snyders, from painting by Vandyke.) Inventor of processes for converting forged iron into steel, and for coating iron with copper, &c. &c. Patents Nos. 161 (1670), 162 (1671).

Schwilgué, constructor of the astronomical clock in the cathedral of Strasburg. (Daguerreotype.)

John Smeaton. (Engraving by Bromley, from painting by Brown.) Constructor of the Eddystone Lighthouse, and inventor of a machine for extracting oil from seeds. Patent No. 1597 (1787).

The Right Hon. Charles Earl Stanhope. (Three-quarter life-size drawing in chalk.) Author of philosophical and political papers, and inventor of improvements in the printing press, in the construction and propulsion of ships and other vessels, in the manufacture of lime, &c. Patents Nos. 1732 (1790), 1771 (1790), 2527 (1801), 3011 (1807).

George Stephenson, F.R.S. (Mezzotint by Atkinson, from painting by J. Lucas.) Inventor of improvements in steam-engines, in railways, in railway carriages, &c. &c. Patents Nos. 3887 (1815), 4067 (1816), 4662 (1822), 6111 (1831), 11,086 (1846).

Robert Stephenson, Esq., M.P. (Engraving by J. R. Jackson, from painting by J. Lucas.) Engineer of the Menai Bridge, the High-Level Bridge at Newcastle-on-Tyne, &c. &c., projector and engineer of various public works on the Continent, in Canada, and in Egypt, engineer and constructor of the London and Birmingham, Chester and Holyhead, and other railways; inventor of improvements in steam-engines, railway locomotion, &c. &c. Patents Nos. 5325 (1826), 6092 (1831), 6372 (1833), 6484 (1833), 6524 (1833), 8998 (1841).

Jedediah Strutt. (Engraving by Meyer, from painting by J. Wright.) Inventor of the " Derby rib-stocking" frame, and of portable cooking apparatus. Patents Nos. 722 (1758), 734 (1759), 964 (1770).

William Symington. (Bust, presented by his Son.) Inventor of improvements in the steam-engine, and of steam navigation. Patents Nos. 1610 (1787), 2544 (1801).

The Same. (Engraving.)

James Watt. (Engraving by C. Picart, from painting by Sir William Beechey, R.A.) Inventor of improvements in the construction and application of the steam-engine, in steam-boiler and smelting furnaces, of a copying machine, a micrometer, a machine for making perspective drawings, &c. Patents Nos. 913 (1769), 1244 (1780), 1306 (1781), 1321 (1782), 1432 (1784), 1485 (1785).

Frederick Albert Winsor. (Engraving from sketch by Dupont.) Projector of public gas-lighting, and founder of the first gas-light companies in England and France; also inventor of distillatory apparatus for the production of gas for illuminating purposes, of a telegraph lighthouse, and of the application of sugar to certain manufactures. Patents Nos. 2764 (1804), 3016 (1807), 3113 (1808), 3200 (1809), 3253 (1809), 3510 (1811), 9600 (1843).

Abraham Wivell, artist and inventor of various fire-escapes. (Engraving by Holl, from portrait by A. Wivell.)

The Same, in costume of fireman. (Drawing by Parrott, presented by A. Wivell, jun., Esq.)

Edward, Marquis of Worcester. (Three-quarter portrait by Alexander Craig, copied from an original of Vandyke by the kind permisssion of its possessor, His Grace the Duke of Beaufort.) Author of " A Century of Inventions," and inventor of an engine for applying steam as motive power, of a method of propelling vessels, of apparatus for instantaneously disengaging restive horses from vehicles, and of improvements in clocks, watches, and fire-arms. Patent No. 131 (1661).

The Same. (Engraving by Robinson, from original of Vandyke.)

Coloured View of the application of Wivell's fire-escape. (Presented by A. Wivell, jun., Esq., son of the inventor.)

Tinted Drawing, representing the application of various forms of fire-escape. (Presented by the Same.)

Tinted Drawing, of similar Subject. (Presented by the Same.)

Such a gallery, as it gradually expands, will become a most valuable record; and we may therefore express a hope, that all who are able to contribute original portraits and busts in aid of its contents, will afford it that general assistance, without which it cannot fairly succeed.

AMERICAN NOTES.

BY OUR OWN CORRESPONDENT.

The Collins Steamers and the American President—Soft Metal Lining for Bearings—Grease and Air-Tight Axle-Boxes—Cooper's Cast-Iron Bearing—Goodman's Hemp-packed Axle-Box—Hopkiss' Adjustable Screw-Key.

Congress adjourned, as in duty bound, on the 4th of March. A bill for the continuance of the subsidies to the Collins steamers passed both houses, but was stopped by the President. The act of July, 1852, increased the pay of these ships—the Collins line of steamers between New York and Liverpool—from 385,000 to 858,000 dlrs., but reserved the right to suspend the increased pay after six months' notice. The new bill virtually proposed to repeal this six months' provision, and this fact alone is made the chief ground of the President's veto, although the evident intention in framing the bill was to leave it optional with the government to refuse the pay at any time. This act of the government is very displeasing to the members of Congress and to the public. The Collins steamers are the pride of every American. No skill or expense was spared in their construction; and they were designed to be the swiftest, as well as the most commodious, strongest, and most beautiful steamers in the world. The entire cost of the four steamers of this line, the *Atlantic*, *Pacific*, *Baltic*, and the unfortunate *Arctic*, amounted to 2,944,143 dlrs. The nominal power of the *Atlantic*, reckoned by English rules (from measuring the cylinder alone), is only 800 horses, whilst the actual power, deduced by the indicator cards, is nearly 2,200 horses.

The first twenty-eight trips of these steamers was at an average cost each voyage of 65,000 dlrs., and the actual average receipts were 48,000 dlrs., leaving an average deficiency each voyage of 17,000 dlrs. The increased pay above alluded to being considerably greater than the whole sum accruing to the government from the receipts for mail matter so carried, enabled these splendid steamers to live and flourish under conditions which would otherwise have been ruinous. The effect of diminishing the pay would probably be to ruin the enterprise, but this disaster is averted, at least for the present, by appropriating the usual sum for this object in the Naval Appropriation Bill.

Mr. Isaac Babbitt's patent for the Babbitt-metal lining for bearings, was extended in 1853 for another term of seven years. The precise nature of this patent, like that of many others in this and in other countries, is decidedly obscure, and a consequence is, that, amid the general confusion, some may unnecessarily pay the sum demanded for infringements. Is there no way of compelling the owners of patent papers to study perspicuity, instead of purposely making the claim so obscure? This Babbitt claim is a good example of the perfection to which ambiguity has arrived in preparing patents. Soft metal linings had been used long ago, but Mr. Babbitt discovered a method of constructing a bearing with a lip around the edge of the soft metal to prevent its gushing out. The regular method of Babbitting is to cast the bearings of brass or iron in very nearly the usual form, but with a rectangular cavity or depression some half inch or more in depth, covering nearly the whole area of its inner or curved surface. This cavity being wetted with diluted muriatic acid, in which zinc has been dissolved, is prepared for tinning. The latter operation is performed by plunging the whole bearing into the kettle of melted metal, and allowing it to remain until heated. The hot bearing is next inverted either upon the journal which it is designed to carry, or another of similar size, and the cavity is filled by pouring the actual bearing metal through a small hole previously drilled. This is the method as practised in one of the largest locomotive establishments in the country, located in the town where Mr. Babbitt first "graduated" as a mechanic; and whether corresponding or not with any instructions accompanying the specification of the patent, it is a very convenient, if not the most desirable, process, where no pains are to be spared. Many persons, however, knowing the patent has nearly or quite expired, have made bearings in the usual form, and drilled the interior full of shallow holes to be filled with soft metal. Others have made the cavities sufficiently dovetailing to retain the metal without tinning, and all have used every possible variety of metal; some large bearings for marine engines being Babbitted with little else than lead. The demands for damages from infringers are being pushed with considerable vigour in some portions of the country; and the extent of the claim being a question of considerable pecuniary importance to owners of any machinery larger than a grindstone, I shall copy it below, asking for some rule to determine whether the tinning is or is not a vital portion of the patent; and if it is not, what the patent does cover? The claim, as printed in the official report lately issued, is for "the making of the boxes (bearings) for axles and gudgeons by the casting of hard pewter or composition metal, of which tin is the basis, into said boxes, they being first prepared and provided, or not, with rims or ledges and coated with tin."

Bearings, lined in some manner with soft metal, are very popular in America, much more so probably than in any other country, whilst brass bearings are frequently dispensed with, and their places supplied by cast-iron. Elementary treatises tell us, that it is desirable to make the metal of the journal and of the bearing as different as possible; instead of which, we consider a cast-iron pillow very nearly the best possible material to support a cast-iron journal, when both are cast from the same ladle.

The writer lately visited a manufactory where considerable attention had been bestowed on this subject, as well as on various oils and other lubricants. The result of the whole was the employment of cheap and very inferior oil, continually and profusely applied. A dish was suspended under each bearing, and a small endless chain was hung on the shaft immediately at the side of the hanger. This chain was continually "overhauled" by the rotatory motion of the shaft, and as it was sufficiently long for some portion to be always in the oil, the effect was a continual dragging up of the oleaginous matter to lubricate the bearing.

The large amount of surface thus continually exposed to the direct, and also to the evaporative, influences of the atmosphere, must be a considerable objection to this practice. Nature provides the joints of the animal system with but a very scanty secretion of oil, yet it may be presumed they are rarely disabled on this account, one circumstance very much in their favour being their covering of flesh.

Mr. Harvey Rice, of Piermont, has lately patented and introduced a bearing for railway purposes, which is true to nature in this respect by being air-tight, and which possesses, in other respects, very desirable qualities, although more difficult to cool in case of accidental neglect than those ordinarily employed, and also more difficult to repair or adjust. The box is designed for carriages having inside bearings, as is the case with most of the rolling stock on the broad guage roads. The box is made in two halves, nearly resembling each other, as represented in fig. 1. The parts are secured together by four bolts, one in each corner. The journal is previously prepared with four rounded collars, as represented in fig. 2, and so arranged that the bearing space is the intermediate plain portion. The brass is represented in fig. 3, and is nearly similar in every respect to those ordinarily employed, with a considerable cavity on the top for the retention of oil, which is protected from dust by the employment of a suitable plug or stopper in the oil hole at the top. The lower box is filled with oiled waste in the usual manner, and may be or not provided with springs or other means of pressing the oily mass continually into contact with the lower surface of the journal. Suitable washers of leather are interposed at the ends, fitting between, and exterior to the collars at each end of the bearing. The bolts for holding the box together have their nuts at the bottom, made doubly secure by the addition of a key. This box is rarely heated from the absence of oil, or by other accident; but, when this does occur, the only remedy known in practice, is to "switch off" and allow it to cool at leisure. To re-line the bearing, or exchange one brass for another, a much larger amount of labour is necessary in "packing up," and the popularity of the box among the operatives is therefore somewhat questionable, although its superiority for general purposes, and as regards economy of oil, is undoubted. Boxes of this kind, now in use on the New York and Erie Railroad, frequently run over the entire distance, 460 miles, without any attention, and a much greater distance could probably be ventured upon with slight danger.

Fig. 1.

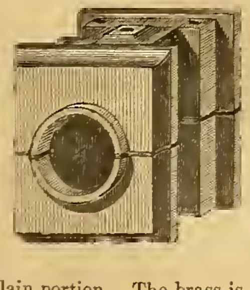


Fig. 2.

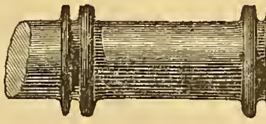
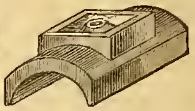


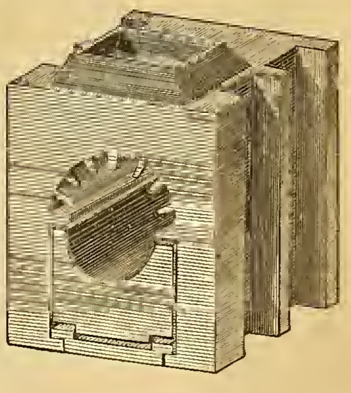
Fig. 3.



Mr. C. D. Cooper, one of the officers on the same railway, has recently introduced a form of iron-casting, designed to take the place of the brass and slide employed in the common form of boxes. The ordinary brass is covered by a slide, whilst, in this arrangement, the whole is accomplished by the single casting, and the bearing is also proportionally cheaper in the ratio of the cost of the material.

But probably the greatest novelty, both to the general reader and the professed mechanical engineer, is exhibited in a style of box, lately introduced on the Buffalo and New York City Railway, by Mr. John Goodman, one of the mechanics employed on the line. The employment of hemp-packing in steam pistons has become nearly obsolete, in consequence of a general conviction of the superiority of metallic rings for such purposes. Whilst this modification has taken place in the preparation of rubbing surfaces when exposed to a high temperature, it may never before have been made a subject of inquiry, whether, under ordinary circumstances, hemp properly prepared may not be economically substituted for metal. Mr. Goodman supports the carriage entirely upon hemp, saturated with lubricating matter. The form of box employed is represented in fig. 4, and, in general appearance, much resembles the ordinary axle-box inverted. The whole is composed of cast-iron. A series of ribs extend longitudinally the whole length of the bearing, and the space between is tightly filled with the fibrous vegetable, which has previously received a thorough saturation with a mixture of tallow, sulphur, and blacklead. Mr. Goodman's patent covers also the employment of flax, wool, cotton, and shavings of leather, instead of hemp; and he is now about putting in use a box, in which the last-named animal material is substituted for the vegetable. The bearing is protected from air and dirt by two thin plates of cast-iron (fig. 5), which are secured to the ends, the lower bolts (fig. 6) passing through slots, as represented in fig. 5, and confining the plate by a key. One hemp-packed box of this kind has now been in use more than four months under a carriage on a gravel train, during two months of which period it was oiled only twice. A first-class passenger carriage has more recently been fitted with a complete set of these boxes, and has now been in daily use more than two months in the mail train, and thus far without an interruption of any kind. The method of packing is very simple. It consists in putting the casting in its place on the axle, or on a "former" of similar size, and tightly driving the moistened packing

Fig. 4.



into its place with an ordinary caulking tool. The oil-box for the retention of drippings is suspended below, the weight being supported by a spring which acts between it and the slide beneath. A cup is cast on the top, as represented, for the retention of oil, those now in use being of such capacity as to hold about three-fourths of a pint. This box is covered by a hinged plate of wrought-iron, and the box all complete weighs about sixty-three pounds, the weight of the ordinary box being sixty pounds. The economy of Goodman's box is sufficiently evident. The entire expense of packing is about 14 cents, whilst the brass bearing usually employed weighs about seven pounds, and costs some two dollars more. The durability of the material, so far as tested, seems to be all that could possibly be desired, as the wear of the box longest in use is as yet scarcely perceptible. The principal point yet remaining in question, is the degree of resistance to motion induced by this box, an impression seeming to exist among some of the operatives on the road, that the carriage so fitted required a higher degree of tractive power than when fitted in the usual way. If this point could be readily and favourably settled, the invention might seem to mark a new era in the history, not only of railway manipulation, but of machinery generally.

Fig. 5.

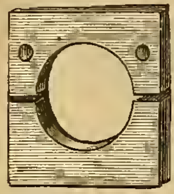
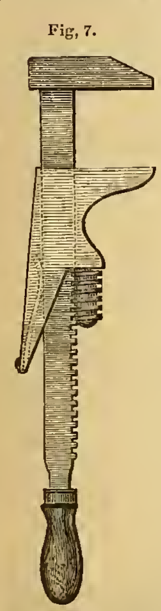


Fig. 6.

Fig, 7.



An admirably simple and readily adjustable form of monkey wrench, for general purposes, has lately been introduced by John Hotchkiss & Sons of Sharon, Connecticut, and is represented in fig. 7. Whilst possessing all the required facility for extreme accuracy of adjustment—the readiness with which it may be made to approximate to the required position, commends it to the favourable attention of mechanics of every class. The wrench is of the usual form, with the exception of the moveable jaw, which is fitted very loosely at the extremity towards the handle, and the short screw, or threaded thimble, is held into gear by the aid of a slight spring, represented by the dotted line. The front edge of the bar, or main shaft, is a portion of an internal screw-thread, into which the threads of the external screw are forced the more tightly as the strain on the wrench increases. To adjust the wrench, a moderate pressure on the thumb-piece, or tail of the shifting jaw, serves to compress the spring, and, by altering the position of the whole moveable portion, lifts the thimble entirely out of gear, in which position the moveable portion may be rapidly slipped to any point desired. If greater accuracy is then required, it may readily be obtained by turning the thimble with the fingers.

SLOTTING AND SHAPING MACHINE.

By Messrs. G. & A. Harvey, Albion Works, Glasgow.

(*Illustrated by Plate* 169.)

In selecting for the opening plate of the eighth volume of the *Practical Mechanic's Journal*, so fine a specimen of tool-making as the large slotting machine made by Messrs. Harvey, we think we shall do no discredit to the long list of illustrative examples of machinery to be found in the seven volumes which have gone before. As a most effective converter of the engineer's raw materials, this tool stands foremost in the particular class to which it belongs—that of long-cut paring machines. Its general contour, and the distribution of metal in its framing, are such as to secure the highest available degree of strength, with a determined mass and weight of material. The great distance between the bearings of the slotting bar gives a correspondingly superior steadiness to the cut—a point of the highest importance as affecting the accuracy of the pared surface, and the consequent value of the work performed. The motion of the gearing is communicated to the slotting bar through a connecting-rod of a length much greater than is ordinarily found in such tools, and hence arises a feature of superiority as regards the diminution of the lateral action. The working parts of the cutting action, too, are not open to any serious objections on the point of overhang, and something is to be said as to the advantageous simplicity of the connecting-rod and face-plate attachment. The gearing involves a pair of elliptic wheels, the effect of which is to confer additional power upon the cut, and a saving of time, by the increased speed of the return stroke.

Our Plate 169 exhibits complete side and front views of the tool as fitted up for use. The framing consists of a single independent standard, A, the contour of which is made up of curves of graceful sweeps, combined with right-line stay portions at the upper overhanging part, to give stiffness. The whole of the gearing is at the back, quite clear of the workman's field of operations. The prime motion is communicated by the triple-speed cone pulley, B, on a short horizontal shaft, C, passing transversely through the main pillar, and supported in bearings therein. A small fly-wheel, D, is added for the sake of steadiness of motion, and for moving the machine by hand in setting the work. The other end of the shaft, C, carries a small bevil pinion in gear with the large bevil wheel, E, supported by the brackets, F, bolted to the side of the standard. The shaft of this wheel, E, also carries a small spur-pinion in gear with the large spur-wheel, G. This large wheel is fast on a short shaft, passed diametrically into the main standard, and having fast upon it an elliptical spur-wheel, H, in gear with a corresponding elliptical wheel, J, fast on the outer end of the last motion shaft for the slotting disc. This shaft is supported in end bearings at K and L in the main standard, as it passes directly through the hollow centre of the straight stay portion of the frame included between these two letters.

The disc, M, for the traverse action of the slotting bar, is fast upon the front end of the shaft just referred to, the disc face being set to work close up to the contiguous faced portion of the framing. The disc has an inserted piece upon its outer face, carrying a setting screw, working a nut fast to the joint stud-pin of the long connecting-rod, N. The upper end of the rod, N. is jointed by an eye and adjustable stud, O, to the upper end of the slotting bar, P, the stud, O, being adjustable vertically in a slot in the bar, so as to enable the workman to regulate the absolute height of the bar to suit different kinds of work. This adjustment is easily performed by the hand-wheel, Q, surmounting the bar, this wheel being fast upon the end of a screw-spindle connected to the stud, O, as a nut. Hence, when an alteration is necessary, the front pinching nut of the stud is slackened off, and the hand-wheel, Q, is then turned until the necessary set is obtained, when the stud-nut is again tightened up.

The self-acting movement for the table gearing is conveyed downwards from the driving gear by the rod, R. The table, S, upon which the work to be slotted or shaped is carried, has a wheel fast upon its under surface inside of the right-line slide-rest piece beneath. Into this wheel, a worm upon the spindle, T, is made to gear; so that, by turning this spindle, the table with the work is made to revolve in either direction, as may be required. In its self-acting movement, this worm-spindle is driven by means of a spur-pinion on the projecting end of the spindle, and by shifting this pinion to the screw-spindle, U, the horizontal slide action of the table is brought into play, for cutting inwards or outwards, the screw of the spindle, U, being entered into a nut upon the slide-piece, in the usual manner. The screw-spindle, V, actuates to give the necessary transverse action. The short lever, W, by which the movements we have described are primarily communicated, is hinged by one end to a fixed stud-pin in the framing. The free end of this lever is slotted to receive an adjustable joint-stud for the upper end of the rod, R. At an intermediate part of this lever is a stud, carrying a small anti-friction pulley fitting into a differential scroll groove, turned in the inner face of the lower elliptical wheel, H, of the driving gear. The scroll groove in this wheel is a concentric circle all round, except at one short portion, where it is extended outward from the wheel's centre. Hence, at every revolution of the scroll-wheel, the lever, W, is struck suddenly downwards, and again raised, giving the same motion to the rod, R. The lower end of this pendant rod is jointed to a short lever, X, which works in a small recess in the side of the base framing, the inner end of this lever being fast upon a rocking shaft, carried in end bearings fast to the interior of the base. The other end of this rocking shaft is geared by a pair of bevil wheels with a transverse shaft, Y, the outer end of which is carried in a pedestal bearing, Z. The end of the shaft, Y, has upon it a crank-lever, with a connecting-rod and catch, gearing with the spur-wheel, *a*, running loose on a stud, and gearing with the pinion of the screw-spindle, V, of the lower slide. Thus, at each action of the rod, R, the screw-spindle, V, receives a corresponding turn, to give the lower slide movement. The same shaft, Y, also carries a crank-lever, *b*, a connecting-rod from which passes to a corresponding lever, working a pair of segmental bevil wheels, *c*. The latter action gives motion to a shaft, *d*, working a catch arrangement for the spur-wheel, *e*, in gear with the pinion on the screw or worm spindles, T, U, for giving the upper slide traverse and the circular action to the work-table. By attaching a wheel to the top of the tool-holder, with a worm working therein, the tool may be made to revolve by the action of the machine itself, and it may thus be made fully self-acting.

The trunnion upon which the slide-rest is carried, is directly beneath the line of cut, so that the cutting strain is always entirely on the trunnion, and not upon the bolts, as is not unfrequently the case in tools of this class. In addition to what we have said, this machine-tool possesses many other points of practical advantage. Its tool-holder is well adapted for cutting internal circles. The tables have a more than ordinary length of traverse in both directions; and the circular action being obtained by gearing which is quite beneath the table, the parts are not liable to damage, whilst a gain is effected as regards the superior bearing afforded by this arrangement. The feed actions are all contrived so as to be well out of the way of the workman, being partly inside the machine; and, lastly, the tool is entirely independent and self-supporting.

The weight of the tool from which our drawings were made is fifteen tons, and its height is fourteen feet six inches. A similar machine has just been sent, by Messrs. Harvey the makers, to the Paris Exhibition.

PEAT COAL AS A SMELTING FUEL.

The intrinsic excellence of the fuel producible from our waste peat bogs, induced us to write, so far back as 1846, that "we should one day be able to manufacture, if not coal, as at present dug from the bowels of the earth, at least a fuel equally useful for all the purposes to which the former is at present applied." Since this early date, it is true that nothing has been done on the large scale, to render waste bog an industrially valuable fuel; but abundant proof has been given of the truth of our original observation. The nine years' interval has witnessed the manufacture of a fine, hard, and rich fuel, far superior in many points to the best pit coal, both as a smelting material, and as a fuel for numberless industrial pursuits.

To accomplish this, the work of many minds has been required, and many varieties of rich carbonaceous material have been developed during the prosecution of the search. But amongst the most persevering and successful promoters of the pursuit, we have to rank the Messrs. Gwynne, of Essex Wharf, London, who have originated and apparently perfected a system of making a solid carbonaceous fuel, and have, besides, satisfactorily applied it in the manufacture of iron.

Dr. Lethehy, of the London Hospital, has examined this fuel, and he reports most favourably upon it. The specific gravity of the block on which he operated was 1·14, its structure being very hard and dense. The actual stowage weight of a cubic foot was 71·24 pounds, whilst Newcastle coal is about 49·69 pounds only. One hundred parts of the fuel contain nine of hygroscopic moisture; and they yield 55 of volatile matter, much of which is condensible, and thirty-six parts of charcoal. The charcoal contains 3·8 of ash.

In submitting one pound, or 7000 grains, of the fuel to distillation in an iron retort, the resultant volatile products were conducted through a red-hot iron tube, in the hope that the paraffine of the tar would be decomposed and converted into a gaseous hydro-carbon of high illuminating power. The results of this treatment were 2520 grains of charcoal, 1320 of ammoniacal liquor, 360 of thick tar, and 2800 of combustible gas. This gas amounted to 6·25 cubic feet, and when burnt at the rate of five cubic feet per hour, from an argand burner with fifteen holes, and a 7-inch chimney, it gave a light equal to that of seven sperm candles, each burning at the rate of 120 grains per hour. One hundred parts of the prepared peat therefore furnish:—Of porous charcoal 36, ammoniacal liquor 18·86, thick tar containing paraffine 5·14, and gas of an illuminating power of seven candles 40· parts.

Dr. Lethehy sums up his report in these terms:—"The amount of gas is very considerable (a ton of the material furnishing as much as 14,000 cubic feet of gas), and although the illuminating power is not very high, yet, from the fact that much of the tar and paraffine had actually been rendered gaseous by their passage through a red-hot tube, there is every prospect that they might be still further decomposed and converted into gases of high illuminating power. The gas, when purified by passing through an alkaline mixture, was found to be entirely free from sulphur; and in this respect it has great advantages over coal gas, for the products of its combustion are wholly harmless in respect of their action on inorganic matter, such as books, drapery, and other perishable fabrics; in its use as fuel, there is no opaque smoke evolved, no sulphurous acid is set free, the heat is quickly raised and quickly diffused, the ashes never clinker so as to choke the bars of the furnace, and that the peat does not contain any metallic sulphuret or other substance that is likely to produce spontaneous combustion. In short, it fulfils most of the conditions which are mentioned by Dr. Lyon Playfair and Sir H. De La Beche, in their report as to the requisites for a good fuel."

The Sheffield steel-makers cannot now get a proper supply of Swedish iron even at £38 a ton. We have no substitute for this costly material in our pit coal iron; but we have a remedy in the employment of charred peat. Good British ore, smelted with peat fuel, would most undoubtedly rival the best productions of Sweden, and at a cost which puts comparison out of the question. Mr. Gwynne, indeed, boldly asserts that, with his process of smelting, he can supply iron for the steel-makers at one-half of the price now paid to Swedish houses.

The uniformity in the character of the iron produced by the peat smelting is a great feature in its favour, and besides this, the quality of the metal is fully equal to what bears so high a price as "charcoal iron." What greater inducements could we have for a trial of the peat system?

Mr. Summerhill of Sheffield has tried charred peat in his charcoal fires, and he finds that, with one ton of the charred but uncompressed Flintshire fuel, he can produce upwards of 2½ tons of "charcoal iron." This iron was made into tin-plate material, weight for weight; charcoal from peat has a greater tendency to make iron "hurrow," in comparison with the common system of treatment, and the product is extremely well suited for the wire-drawer. The blast pressure under which Mr. Summerhill worked in the case which we have adduced, was 2½ pounds. If we have so excellent a smelting material lying in abundance before us, we shall have ourselves seriously to blame if we neglect its very evident application.

THE ROYAL SOCIETY.

III.

It very materially confirms the views to which we have endeavoured incidentally to draw attention with regard to the successful establishment of all societies, when we remember the history of some of those whose occupations consisted simply in learning and making known that which was already known. In 1717 a purely mathematical society was established. It was rational to suppose that here there would be scope for the labours of a long existence. It flourished for a time, but gradually dwindled away, although it possessed such vitality as even to survive the year 1847. It was, in reality, but a school of one exercise. It is further significant that all the books and property of this society should have been handed over to the Astronomical Society, whose views and efforts are constantly being extended. But this, and every new fact of interest discovered, has tended only to confirm and farther establish its position as a living body. Whatever was known to be *new* was first ascertained to be *true*, and then the other workers came to find out new relations. The experiments directed to be made were often of great moment—sometimes, of course (looking at them from our present position), simply insufficient. Electricity, and the spur given to the science of its laws by Franklin, claimed great attention. No society of any kind can ever last long that has in it at its origin the very seeds of decrepitude; as, in a civilized country like our own, it is not possible for any society to decay when it is once established on a proper progressive basis. The Royal Society shows the singular fact of the slowness with which the human imagination receives any new wonder in science, or perhaps the dullness in which it chooses to rest, rather than take a hint and grasp—not the fact in all its extent only—but a wide law regulating it, and other analogous phenomena, when we refer back to most of the early experiments relating to electrical phenomena, and to the impression made by them. In 1731, the Prince of Wales, with the Duke of Lorraine, visited the Society, to be gratified with an exhibition of some of these. Electricity was then claiming much attention, and the great distance at which the shock might be communicated was regarded with surpassing admiration. About the middle of the last century some experiments on this point were made near Shooter's Hill, when the wires formed a circuit of four miles, and the shock conveyed, as it is solemnly recorded, "a distance which, without trial, was too great to be credited!"

Much praise is due to the Society—and, indeed, their present position may be owing to it—that they never mixed themselves, as a body, up with any controversy; and they have sometimes gone even so far as to warn the public against the improper reception of statements which have been, in the order of business, submitted to the members, and for which the authors have been decreed public thanks. Here is again a difference between it and our ordinary societies which deserves attention. The latter, particularly in provincial towns, seem, almost without exception, to be identified with a sect or a party, and too ready to father all the idiosyncracies and even absolute errors of the principal pecuniary supporters. Why should this be? The little history we are upon shows very obviously why it should not.

Such a quantity of puerile matter had got mixed up in what were called the Transactions of the Royal Society, that in 1753 the general body of members considered it necessary to inform the public that hitherto these *Transactions* had been edited by the secretary alone, but that thenceforth they would be published under the superintendence of a council of the members. Which of our provincials could feel powerful enough to root out thus the manifest errors of its constitution, and come boldly forward with the charms of truth alone for its support?

In 1758, John Dolland had awarded to him the Copley medal for his celebrated discovery of achromatic lenses, or, as it is stated in the minutes, "for his curious experiments and discoveries concerning the different refrangibility of the rays of light."

Shortly after this, arrangements were made for sending out Maskelyne to St. Helena, and Mason and Dixon to Bencoolen, to observe a transit of Venus—a natural occurrence only once before observed, and then by an Englishman. The king's furnishing the necessary funds, which amounted to £1,800, was a graceful commencement of the reign of George the Third. The Admiralty provided a ship of war to carry out the observers. From the state of the weather, Maskelyne could take but two observations, while, from an untoward action with a French frigate, the observations at Bencoolen stopped short at the Cape of Good Hope. From all the observations recorded at these two points and in this country, the solar parallax was ascertained to be 8″52. In 1769 still greater exertions were made, at the instance of the Society, to observe this most interesting physical event, and £4,000 were obtained to pay the expenses. These exertions were justified, as we still have to wait some years before another transit of Venus can be observed. On this occasion, Captain (then Lieut.) James Cook and Sir Joseph (then Mr.) Banks proceeded together in the *Endeavour* to Tahiti, while others were despatched elsewhere, to make the observations. Kippis, in his "Life of Cook," observes that—"the anxiety for such weather as would be favourable to the success of the experiment, was powerfully felt by all the parties concerned. They could not sleep in peace the preceding night; but their apprehensions were happily removed by the sun's rising on the 3d of June without a cloud." The solar parallax was, from all the observations made, found to be 8″7.8.

At the commencement of the American war, a very remarkable controversy arose respecting blunt and sharp points for lightning conductors. Franklin, their discoverer, advocating the sharp points now in common use. Fortunately, the President of the Society, Sir John Pringle, held also to sharp points, although the chief magistrate himself, and a large number of his subjects (not confined to the Fellows), took the opposite view, obviously from political motives. Poor old George the Third, then, be it remembered, in his prime, sent for the contumacious President, and earnestly entreated him to use his influence in opposing the sharp points, or, as he worded it, "in supporting Mr. Wilson," a gentleman then identified with the latter. The President nobly replied, "Sire, I cannot reverse the laws and operations of nature." With many, says a writer of that period, the opinions of a philosopher as to the *blunts* and the points were regarded as the index of his opinions on the American war; and the celebrated dispute among the *little* and the *big-endians*, recorded by Lemuel Gulliver, furnished an apt representation of the folly and the rancour which found their way into this discussion.

In 1770, Priestley became a correspondent, and a paper on his "experiments and observations on charcoal" was read.

In 1771, the Society again organised an expedition of discovery under Captain Cook, and it is remarkable, as a sign of the times, that Priestley was rejected as astronomer, on account of his religious opinions. In a letter (which has been preserved) to Sir Joseph Banks, the philosopher speaks out, in no measured terms, his righteous indignation. He was afterwards consoled by having awarded to him, in 1775, the Copley medal, for his celebrated "experiments on different kinds of air."

In 1774, died Henry Baker, F.R.S., who, by his will, bequeathed a sum of money to the Society, the interest of which he directed to be applied "for an oration or discourse to be spoken or read, yearly, by some one of the Fellows, on such parts of natural history or experimental philosophy as the President and Council should please." Thus was the celebrated Bakerian Lectureship instituted, and in which many valuable additions to science have been published to the world. The last Bakerian lecture was read this year on the 24th of January, by Professor John Tyndall, "on the nature of the force by which bodies are repelled from the poles of a magnet."

All along, the Royal Society, as part of its labours, undertook and performed some of those which the Society of Arts now pre-eminently engrosses. Thus, in 1777, it caused inquiries to be made into the commercial value of several products of the Hudson Bay Company, which had been forwarded only as specimens for the Museum, or Repository, as it was called. It had ascertained by experiments, and considered particularly, that the buffalo hides might be used as a good substitute for Russian hides, for bookbinding and other purposes, and had established a valuable commodity in the down of the wild swan, then used largely, as now more moderately, for powder puffs.

In 1779, the Museum was presented to the Trustees of the British Museum. This gift was principally owing to the small accommodation which was proposed to be afforded to the Society in their present apartments, then being erected by Sir William Chambers, and which the Society prudently did not feel justified in declining to accept at the hands of the then existing Government.

In 1784, the great leading discovery of the composition of water was made by one of the members—Cavendish, or, according to others, by Watt, or, as others urge, by Black; but it was probably one of those singular independent discoveries by each, as if nature were jealous that any one in particular should be entitled to the large renown consequent upon it.

In the same year, proceedings were commenced for determining the difference of longitude between the observations of Paris and London, and shortly afterwards the base line of 27,404 feet was measured on Hounslow Heath. Ramsden had the construction of a more perfect theodolite for measuring the angles. He took three years to do it. His delay was proverbial. A curious anecdote is related of this. He was occasionally accustomed to make instruments for the Royal use. On one occasion, the king was apprised of Ramsden's attendance in an antechamber, according to appointment. The instrument-maker was admitted, and having shown his majesty's order for the appointment, the king replied, "You are precise, Mr. Ramsden, with regard to the hour and day of the month, but you are a year behind the time I appointed." In fact, Ramsden had mislaid the king's memorandum, and forgotten all about it, until it accidentally turned up in the course of the following year. The triangulation was carried out by General Roy, and the trigonometrical survey of England and Wales has been in course of being regularly made since 1821, upon the basis thus early found.

In 1785, the scheme for making Herschel's great reflecting telescope was proposed, and carried out at the expense of the king. It was completed in 1789. The very first result was the discovery of a sixth satellite of Saturn, and in 1795, Miss Caroline Herschel discovered Encke's comet. The total cost of this celebrated instrument was £4,000.

The distinguished John Hunter obtained the Copley medal in 1787, richly deserving it, if we look at the truly Royal collection of anatomical preparations to be found in the Museum of the College of Surgeons, and remember that the origin is to be traced to this remarkable man.

The Parent Society, as we may call the Royal, first began about this time to send forth its off-shoots—a natural consequence of all societies *ejusdem generis.* The Linnæan Society was founded by Sir James Edward Smith, who had become the lucky purchaser of the celebrated collections of Linnæus. It appears that the ship conveying the stores to England had just sailed, when Gustavus the Third of Sweden, who had been absent in France, returned home, and sent a vessel to the Sound to intercept its passage; but it was too late.

In 1792, Sir William Jones presented the Society with his celebrated MSS., which gift was increased at his death, in 1794, by the presentation, by Lady Jones, of numerous books in the oriental languages.

The distinguished Volta, in 1793, communicated to the Society his celebrated and leading experiments. He did the Society also the honour first to introduce to it the original of the now common Voltaic battery.

Scarcely five years elapsed when Cavendish made his grand experiments relative to the mean density of the earth, which he ascertained to be about 5·45. Mr. Bailey's subsequent experiments on the same subject increased the density to 5·6604.

Our present Astronomer-Royal has lately been making experiments of a more delicate and decisive kind, and their results are looked forward to with great interest.

It is very singular, as exhibiting the condition of national sentiment in 1798, that the Fellows unanimously voted £500 towards the defence of the country.

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Yachting Magazine, 1854, vol. 3d, 8vo., 14s., cloth. Hunt.

RECENT PATENTS.

RAILWAY WHEELS AND BRAKE BLOCKS.

J. E. M'Connell, *Wolverton.—Patent dated July* 6, 1854.

Fig. 1.

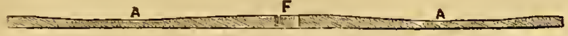
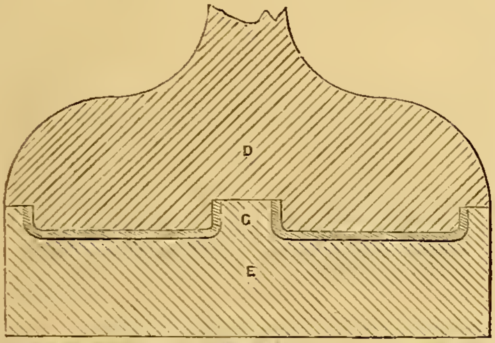


Fig. 2



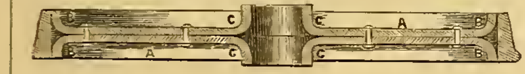


Fig. 3.

This invention, as far as regards railway wheels, relates to apparatus for shaping wrought-iron discs, or slabs, into suitable forms for the construction of the wheels. Figs. 1, 2, and 3 of our engravings refer to one description of wheel: fig. 1 being a section of a disc or plate, such as is used in making the wheel; fig. 2 a vertical section of the pressure die for shaping the disc; and fig. 3 a transverse section of the finished wheel. The wheel is composed of two discs, A, bolted together, and formed with outer turned-up edges, B, for the rim, and central turned-up edges, C, for the boss. The requisite shape is given to the plates by means of the die, D, and counter die, E, which are brought together upon the heated metal by hydrostatic pressure, or any other convenient means. The disc of metal, A (fig. 1), is formed of an increased thickness at the rim and at the centre, so as to make the turned-up portions of uniform thickness with the rest of the disc. A central opening, F, is made in the disc, and this is placed upon the projection, G, of the lower die, E. Then, as the die, D, comes down, it presses the disc into the sunk portions of the lower die, the raised portions of the latter turning up the edges of the disc to the required shape. When the discs, A, are bolted together back to back, a tyre is shrunk on, which completes the wheel. Fig. 4 represents a transverse section of a slightly modified form of wheel. Here a single disc, A, is used with a turned-up outer edge, the rim flange, B, and boss flanges, C, being composed of separate rings riveted to the disc, A, these several pieces being made with suitable dies; or the disc, A, may have one of the boss flanges, C, formed upon it, being similar in shape to the disc in the die apparatus represented in fig. 2, but having a slightly increased thickness to give the requisite strength. The wheel is completed by shrinking on the tyre, as in the previous example. In fig. 5 is represented a form of die for shaping the body portion of a railway wheel out of a single piece of wrought-iron. Fig. 6 represents the finished wheel in transverse section. In making wheels according to this system, either solid slabs or plates of iron may be used, or the blanks may be built up of separate pieces welded together, and approaching approximately to the shape of the wheel. Such a built-up blank is represented in fig. 7. Here the disc of the wheel consists of two layers of segments arranged so as to break joint, and rings are added to form the rim and boss flanges. The dies are formed with projections and recesses, the central eye for the axle being produced by the projection, H, in the lower die. The wheel is completed by shrinking on the die as before.

Fig. 4

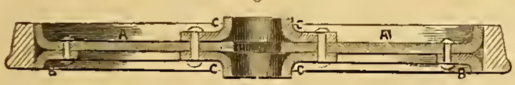
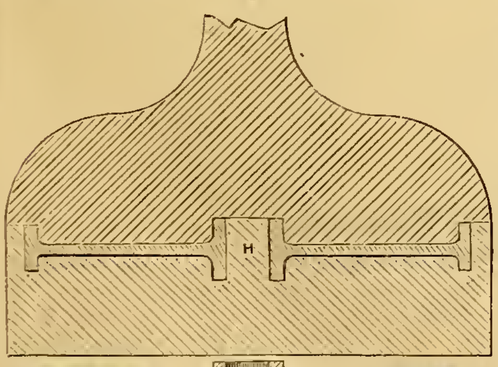


Fig. 5.



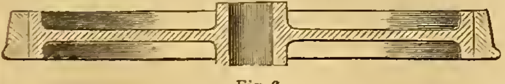


Fig. 6.

Fig. 7.

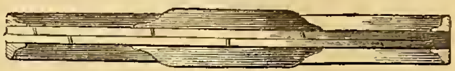
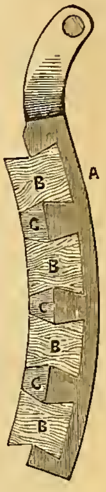


Fig. 8.



Mr. M'Connell's improvement in railway brakes is represented in fig. 8, and consists in making the back, A, of the brake block of cast or wrought iron, formed with dovetail grooves on the face. The frictional surface is formed by angular pieces of wood, B, the interstices, C, between which are filled up with lead, or any other suitable frictional material. By employing brake blocks of this description, a great saving of wood is effected, since in place of the whole back of the block being rendered useless by the wearing away of the face, the small blocks, B and C, alone are required to be renewed in the improved brake block.

SMOKE-CONSUMING FURNACES.

T W. Dodds, *Rotherham.—Patent dated April* 24, 1854.

Mr. Dodds is another of the large class of mechanical improvers, who have turned their attention to the extinction of the smoky abominations of our manufacturing atmosphere. His invention consists in the employment in furnaces of a series of auxiliary hollow fire-bars, through which, if the furnace is applied to a steam-generator or water-heater, the water of the boiler is allowed to circulate. The smoke or bituminous vapour of the green fuel is caused to pass through fuel that has been previously coked, and which is pushed forward upon the auxiliary bars; or a separate door may be employed for supplying the auxiliary bars with coke. In this arrangement the coked fuel takes up, for the supporting of its combustion, the smoke and unconsumed gases evolved from the newly-supplied fuel, at the same time that a certain amount of atmospheric air is admitted at the front, sides, and top, and through or behind the bridge of the furnace. The auxiliary bars or furnace may be connected to boilers or steam-generators of any shape and form, and may either constitute a portion of the boiler, being attached thereto, or simply serve for heating feed water. This description of furnace is applicable also to puddling and reverberatory furnaces, and to the heating of water for warming purposes; whilst it may be modified to suit almost any position, whether for land or marine boilers, or for locomotive engine boilers. The auxiliary bars may be laid either horizontally, at an angle, or vertically. In locomotive engine boilers the same general principles may be carried out by placing a furnace at each end of the boiler. In the front, or smoke-box furnace, it is proposed to burn coal, from which the smoke and unconsumed gases, passes along an internal flue or flues running through the barrel of the boiler, and opening into the ashpit of the second furnace, the bars of which are made hollow, the water of the boiler circulating through them. The fuel employed in this furnace is coke, and the smoke and unconsumed gases from the coal furnace pass through the burning coke and become consumed. A second flue or series of flues conducts the heat back again along the barrel of the boiler into the smoke-box. By another arrangement the two furnaces may be contained in one fire-box, the auxiliary bars supplied with coke from a separate door being placed above the bars containing the coal, so that the whole of the products of combustion of the coal must pass through the burning coke. A third arrangement consists in placing the auxiliary bars at an angle, with one end resting in a water-space division piece running transversely across the fire-box. This division piece serves to direct the products of combustion from the coals burnt in the lower grate, down through the auxiliary bars and burning coke, into the flues of the boiler which are situated beneath them. In order to keep up the circulation in the auxiliary bars, a water-pipe or water-pipes may be employed, in some cases connected with another portion of the boiler. In these last described arrangements, only one set of bars are directly open to the atmosphere, the water bars not being open to the atmosphere. In the puddling or other furnaces, when applicable, air-passages through vessels containing water may be employed for heating the air to feed the furnace above the bars, by allowing a natural current of air to pass through them. Auxiliary bars may be used in all furnaces, whether for engines, puddling, reverberatory, or other purposes.

By another arrangement, a coke oven is employed for the purpose of partially coking the coal before being pushed forward upon the bars. During the coking, the bituminous vapour passes over the bars, and is taken up in combustion by the better coked part of the fuel. Recesses are made for heating the air before it is admitted into the furnace.

Fig. 1 of our engravings is a plan, half in horizontal section, of the furnace of a cylindrical boiler with external flues, fitted with coking ovens or retorts for coking the green fuel before entering the furnace.

Fig. 1.

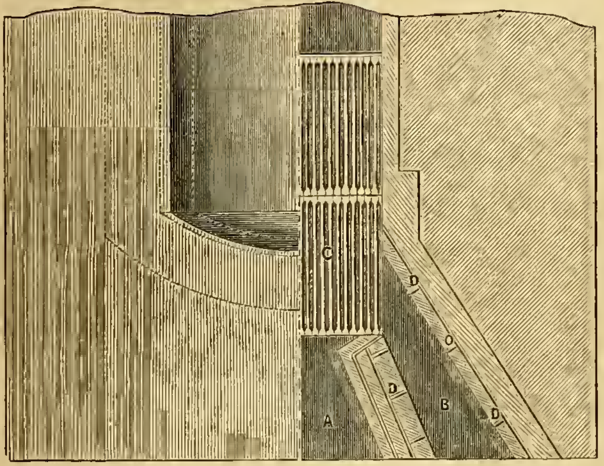


Fig. 2 is a vertical longitudinal section of the furnace. On each side of the principal entrance, A, to the furnace are formed two coking ovens, B, which open into the front end of the furnace, C, at the sides. These ovens are filled with fresh or green fuel through the hoppers, C′, fitted with sliding doors, and inverted funnel-mouthed passage, C″. This fuel is allowed to coke or bake, previously to being pushed forward into the incandescent fuel in the body of the furnace. A plentiful supply of air is admitted by the apertures, n, situated in the sides of the coking ovens over the fire-place and through the bridge, E. This bridge is constructed to give a large heating surface to the air-passages, which may be made zig-zag, as in plan, or they may be made alternately in the header and stretcher courses of the brickwork. A second bridge, F, is situated at a short distance behind the first bridge, by which arrangement the heat is more confined, and consequently more economised than when passing direct along the flues to the chimney. The space between the bridges forms also a combustion chamber, wherein the smoke and unconsumed gases are ignited and consumed.

Fig. 2.

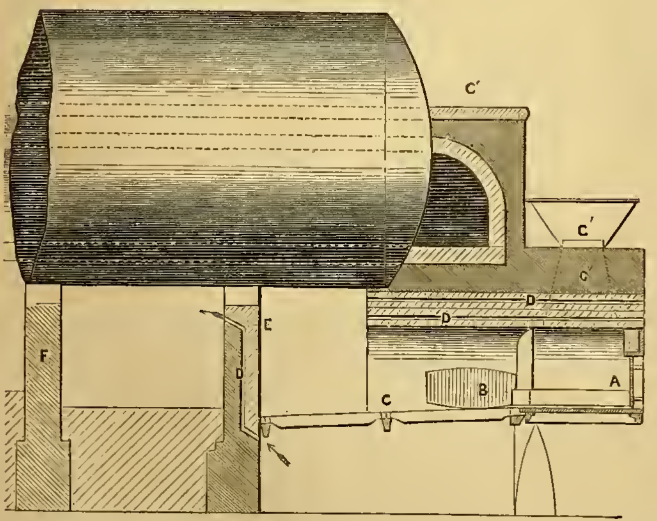


Fig. 3.

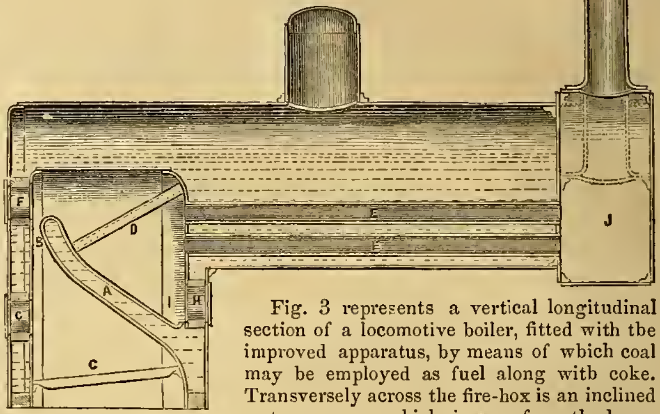
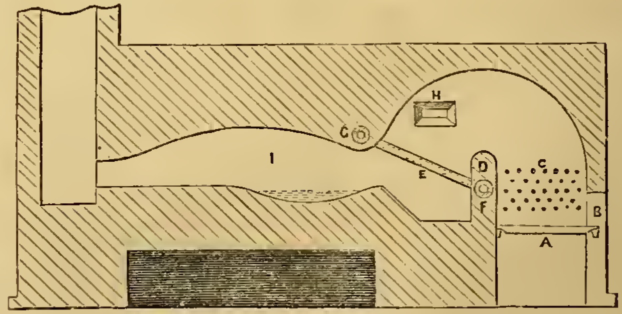


Fig. 3 represents a vertical longitudinal section of a locomotive boiler, fitted with the improved apparatus, by means of which coal may be employed as fuel along with coke. Transversely across the fire-box is an inclined water-space, A, which rises up from the lower portion of the back of the fire-box to within a short distance of the front of the same, a small space, n, being left, to allow the smoke and gases evolved from the coal in the grate, C, to pass into the upper portion of the fire-box, and be brought into direct contact with the incandescent coke on the auxiliary water-bars, D. These bars, which are not open to the atmosphere, are slightly inclined, and are fitted, at their lower ends, into the upper portion of the water-space, A; whilst their upper ends are fitted in to the upper portion of the back of the fire-box, above the mouths of the tubes, E. The auxiliary bars, D, are supplied with coke through the upper fire-door, F, and the lower grate is supplied with coal through the bottom fire-door, G. At H is a door for the removal of the ashes from the ashpit, I. At J is the flame or combustion chamber. Should it be found necessary to reduce the size of the combustion chamber, the top of the barrel of the boiler may be elongated, and the chimney dropped through, as shown by the dotted lines. Any number of tubes or flues, E, may be employed. The smoke and gases arising from the coal fire ascend through the passage or opening, n, and penetrate through the incandescent coke on the auxiliary bars, n, before entering the tubes of the boiler, and are consequently consumed, or ignited, before reaching the flame-chamber end of the boiler. By the aid of the inclined water-bars, n, a constant circulation of water is kept up in the boiler, thereby tending to generate the steam more rapidly than in the ordinary locomotive boilers.

Fig. 4 represents a longitudinal vertical section of a double-draught puddling furnace, as fitted with the smoke-preventing apparatus. The furnace, A, is supplied with coal through the feeding aperture, n. A series of air-holes, C C, are formed in the sides of the furnace, to aid the combustion in the grate, A. Immediately behind the bridge, D, are situated the inclined auxiliary water-bars, E, which are fitted at their extremities into the water-pipes, F and G. This auxiliary grate is supplied with coke through the aperture, H, and the smoke and gases from the fire-grate, A, must, of necessity, pass through the incandescent fuel on the auxiliary bars, E, and be there consumed, before entering the main body, I, of the furnace.

Fig. 4

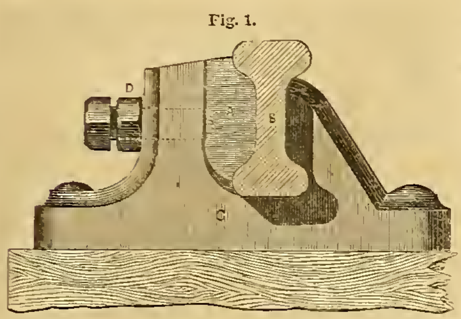


RAILWAY CHAIR FASTENING.

J. Ashworth *Twiton.—Patent dated July* 15, 1854.

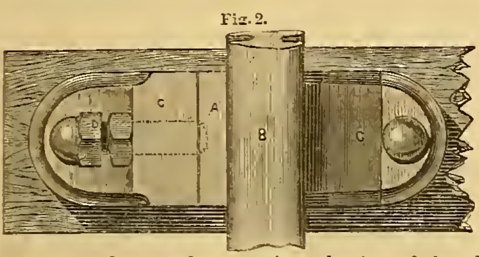
Our engraving, fig. 1, is an elevation of Mr. Ashworth's improved railway chair and fastening, and fig. 2 is a plan corresponding. A key or plate, A, is employed for firmly holding the rail, B, in the socket of the rail, C. This key-piece, A, is made to fit the channel of the rail, and it is tightened up against the rail, and held in position by a screw, D, which is tapped through the jaw of the chair.

Fig. 1.



The screw, D, bears against the key, A, just entering a slight recess in the back of it, so that whilst it is held tightly and firmly against the rod, it is at the same time prevented from moving longitudinally, and cannot be shaken out of the chair. A jam, or lock nut, is passed upon the screw, D, and screwed up against the jaw of the chair after the screw has been adjusted, thereby preventing all liability to work loose. At the junctions of the rails, double chairs are used, and in them the key plate, A, is held in position by two screws.

Fig. 2.



This is a most effective mode of holding and adjusting the rail, and the security of the parts, when set, is undeniable.

RAILWAY BEARING, BUFFER, AND DRAW-SPRINGS.

William Warcup, *Bristol.—Patent dated July* 17, 1854.

In this invention, Mr. Warcup introduces a novel arrangement of metallic springs for railway purposes. Fig. 1 of our engravings represents a sectional side elevation of the bearing apparatus of a railway truck, showing the application of the improved description of spring; and fig. 2 is a partial edge view corresponding. Fig. 3 is a horizontal, and fig. 4 a vertical section of a combined buffer and draw-spring apparatus, as constructed on the new system. Mr. Warcup derives the spring action from a combination of V or U-shaped springs, which may be made of either steel, wrought-iron subsequently converted into steel, or annealed cast-iron.

Fig. 1.

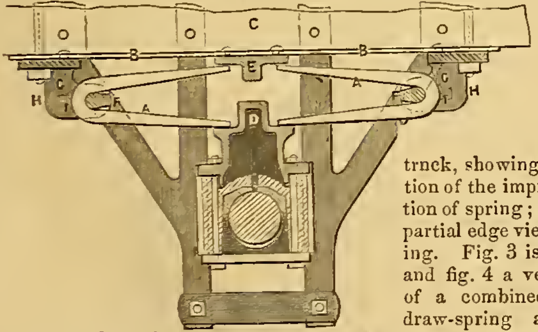
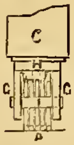
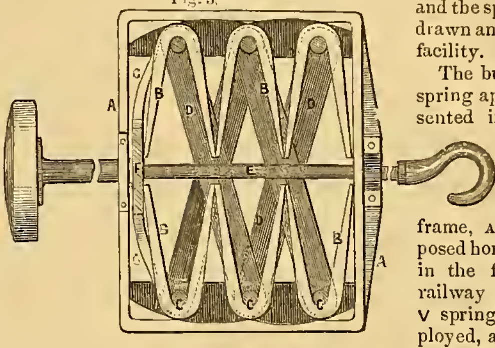


Fig. 2.



In the bearing apparatus, represented in figs. 1 and 2, the V springs, A, are connected to a plate, B, fixed to the under side of the framing, C, of the truck. A series of the V springs are placed side by side, as shown in fig. 2, so as to form a single compound spring. A spring, or set of springs, is set on each side of the axle-box, the extremities of the lower legs of the springs bearing against the top, D, of the grease-box, whilst the upper extremities bear against a block or shoe, E, secured to the under side of the truck framing, C. The springs are supported by a transverse spindle or pin, F, fixed or cast between the cheeks, G, of bracket pieces, H, bolted to the under side of the framing. A key or cotter, I, is fitted transversely behind, and bearing against the apices or bends of the series of springs, in order to retain them in their proper places. When any of the springs require to be removed, the transverse key, I, is knocked out, and the springs are withdrawn and replaced with facility.

Fig. 3.



The buffer and draw-spring apparatus, represented in figs. 3 and 4, is contained in a rectangular cast or wrought iron frame, A, which is disposed horizontally within the framing of the railway carriage. The V springs, B, here employed, are arranged in sets, and are held in position by pins, C, connecting an upper and a lower series of lazy-tongs levers, D, which combine the springs into a system. In order to show the application of the apparatus to both buffers and draw-bars, a buffer is represented at one end of the spindle, E, and a draw-hook at the other. The spindle, E, passes longitudinally through the frame, A, and has fixed to it a shoulder-piece, F, which, on the buffer being pushed inwards, presses against the ends of the springs at that end of the frame, whilst the arms, G, fixed to the shoulder-piece, F, press against the front ends of the lazy-tongs levers, D. The springs will thus be forced together, whilst the lazy-tongs action will cause them all to traverse uniformly, always keeping their inner ends at the same distance from the centre bar, E. The action of the draw-hook will be precisely similar, except that the shoulder, F, will be drawn against the springs by the rod, E, instead of being pushed inwards by the buffer.

PERMANENT WAY.

T. Wright, *London.—Patent dated July* 15, 1854.

The distinguishing feature of this invention is the employment of a single sleeper, as a complete piece of roadway in itself, consisting of a single massive piece or casting, capable of sustaining a pair of rails, and being without longitudinal or transverse joints. The sleepers may be made either of cast or wrought iron, being constructed similarly to the bed frame of a lathe or planing machine. This sleeper-frame, when combined with others of a similar construction, constitutes the iron way of the railroad. Several modifications of this arrangement are comprehended in the patent, which also includes a vice-jaw fastening for securing rails, either in ordinary rail chairs or to Mr. Wright's improved sleeper.

Fig. 1.

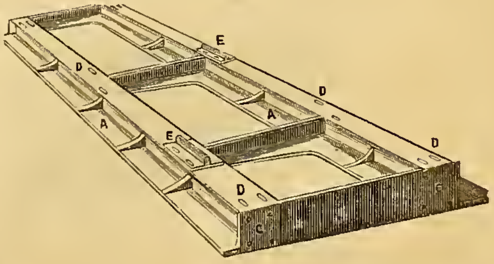
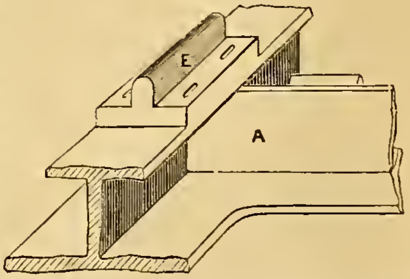


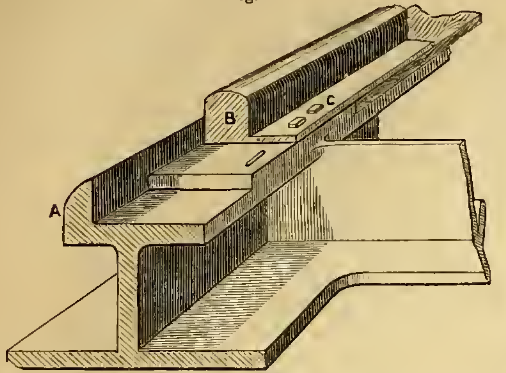
Fig. 1 of our engravings is a perspective view of a single cast-iron sleeper-frame, as constructed according to the improved system. The frame, A, is formed with flat-surfaced T girders, D, standing up from the bottom horizontal flange, and tied together by transverse flanges or bars. The lengths of sleeper-frames, which are each about twelve feet long, are bolted together at C. The rails are laid above the girder portions, D; and snugs, E, are cast or fixed upon the frame at intervals, to give the requisite cast or lateral inclination to the rails. This snug-piece, E, is better seen in fig. 2,

Fig. 2.



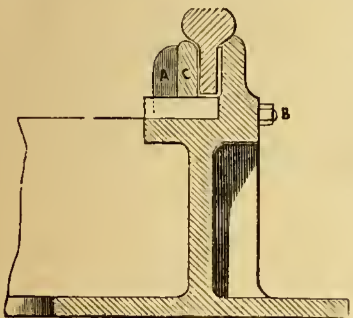
which represents a detached portion of the sleeper-frame as drawn to a larger scale. Fig. 3 represents a detached portion of a sleeper-frame, which is slightly modified in its details. A vertical flange, A, is formed along the outer side of the horizontal girder flange which runs under the rail. The piece, B, for giving inclination to the rail, is bolted to a raised portion of the horizontal flange, and a thin board is shown as introduced along the surface of the horizontal flanges, to lessen the rigidity of the structure.

Fig. 3.



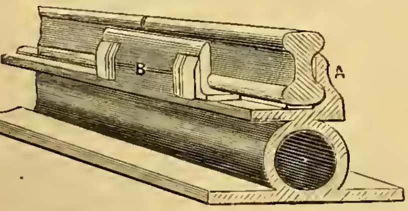
A detached portion of another modification of sleeper-frame is represented in fig. 4. Here a sleeper vertical flange is formed along the outer edge of the horizontal girder flange, this form being especially adapted for carrying a rail of ⊤ section, as represented in the figure. The rail is represented as secured by means of a modification of Mr. Wright's improved vice-jaw fastening. A moveable jaw-piece, A, is tightened up by means of the screw-bolt and nut, B, against the key or wedge-piece, C, which binds the rail against the flange on the other side of it.

Fig. 4.



In fig. 5 is represented a portion of a continuous tubular sleeper, also comprehended in Mr. Wright's patent. Here a horizontal flange is cast upon the top surface of the tubular portion of the sleeper, and this horizontal flange is formed with a vertical flange or rib, A, against which the rail is held by vice-jaw fastenings at intervals, as at B.

Fig. 5.



Mr. Wright's great object is the formation of permanent way on a system of complete and independent framing. There is now no blinking the question as to going to greater expense in making our iron roads much more solid and substantial than hitherto, for the use of light and cheap roads is but sorry penny wisdom. The inventor, whose works we have just noticed, assumes that the question is settled in favour of superior road structures; and further, he practically exemplifies what at least can be done for attaining undoubted security. We think he is pretty nearly right on both points.

SMOKELESS FURNACE FOR STEAM-BOILERS.

James Robertson, *Kentish Town, London.—Patent dated Dec.* 5, 1855.

Mr. Robertson is another of the declared enemies of our manufacturing smoke, and his plans present some features of considerable novelty, which is saying a great deal, considering the numberless plans already suggested for attaining the same object. According to one portion of the invention, the fire bars are made moveable, and when fresh fuel is put upon the fire, it causes the bars to descend a short distance within a perforated or grated framing, through the sides of which an increased supply of air enters the fire. Then, as the fuel is consumed, counterweights gradually raise the bars, at the same time cutting off the ingress of the air at the sides of the grated frame. Fig. 1 of our engravings is a vertical section, and fig. 2 is a horizontal section of a boiler, fitted with a furnace on the improved system. The boiler, A, is of the ordinary cylindrical class, with an internal cylindrical flue, B. The fire bars, C, are moveable, their inner ends resting upon the fixed transverse support, D, whilst their front end bears upon the moveable support, E, which is connected by links, F, to the pair of balance levers, G. In fig. 2, a portion of the fire bars are supposed to be removed to show the levers, G, beneath. These levers oscillate on the fixed transverse rod, H, and are weighted at I, so as to balance the fire bars. The moveable portion of the grate works in a fixed cast-iron frame, J, which projects downwards a short distance, and is formed with grate openings at its front end and sides to admit air to the fire. When a fresh supply of fuel is thrown into the furnace, the grate bars will be depressed by the weight of the fuel to the position shown in fig. 1, which is their lowest position. A considerable amount of air will then be admitted by the grate openings in the frame, J, in addition to that entering from below between the grate bars, because in this position the side openings of the frame, J, are above the grate bars, C, and communicate with the interior of the fire. Afterwards, as the fuel loses weight from being consumed, the balance weights, I, raise up the grate bars, C, and gradually cut off the supply of air through the grate openings in the frame, J. In this manner the supply of air is always regulated by the quantity and condition of the fuel in the furnace, and little or no smoke is in consequence allowed to pass off. The consumption of the smoke is further assisted by the addition to the furnace of a perforated burner, K, near the inner end of the furnace. This burner may be constructed of cast-iron, fire-clay, or of any material capable of withstanding the heat to which the burner is exposed. Fresh air finds its way to the interior of the burner by the pipe, L, which passes along the bottom of the ashpit, and is formed with an open mouth, M, at the front of the boiler. If necessary, a damper may be fitted into the pipe, L, to regulate the supply of air to the burner. The air enters the furnace in a number of small streams, or jets, having been previously heated by the fire surrounding the burner. By placing the burner in the fire, and by bringing the air into immediate contact with the smoke and gases, the consumption is found to be more complete than when the air is mixed with the gases after they have passed away from the fire. The burner may be varied in shape in many ways, and the mode of balancing the grate bars may also be variously modified to suit different arrangements of furnaces.

Fig. 1.

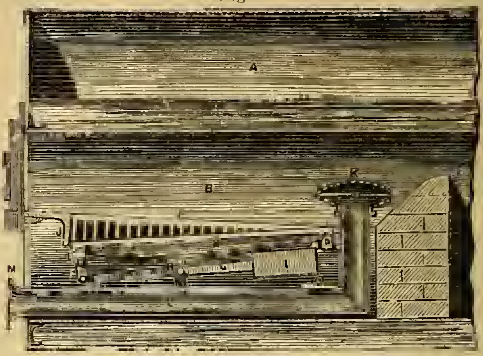
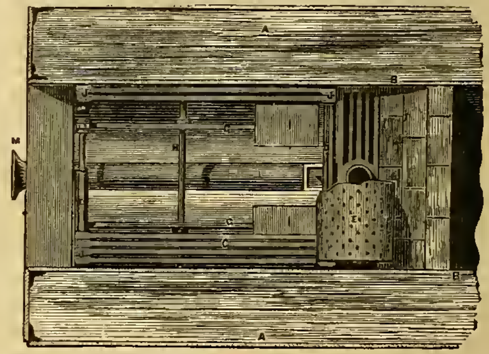


Fig. 2.

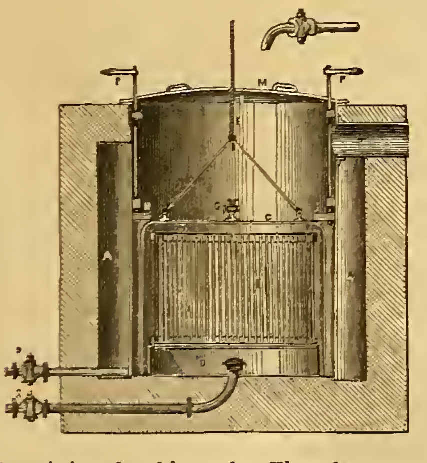


PREPARATION OF SILK AND OTHER TEXTILE MATERIALS.

J. H. Johnson, *London and Glasgow.*—(Alcan and Limet, *Paris.*)

Patent dated May 28, 1853.

In the ordinary routine pursued in the manufacture of silk, the preparation of the cocoons for winding is effected by steeping them in water of a temperature slightly below the boiling point, for the purpose of softening the gummy or glutinous matter which causes the threads to adhere together. As the cocoons contain air, they float on the surface of the water, and do not become completely saturated unless the water is poured upon them continuously. When the cocoons are saturated with the water, they are beaten with brooms of various forms and sizes, in order to raise the outer layer or floss of the silk, and to expose the main thread, which ought then to unwind until the entire cocoon is exhausted, that is, if the cocoon has been properly treated. Whatever care, however, may be bestowed on the treatment of the cocoons by this system, the silk will always be rendered inferior, whilst the process is attended with considerable expense. The immersion of the cocoons in the manner described, does not admit of their being saturated, unless the operation is carried to an extent which, from its excess, becomes injurious to the outer layers, thereby occasioning greater waste in the subsequent process of beating. Again, when the outer layers of the cocoons have not been too much acted upon in the immersing process, it generally happens that the innermost layers are not sufficiently loosened, rendering the silk liable to frequent rupture during the unwinding process, and this necessitates renewed beatings, by which a large portion of the silk is depreciated by being converted into floss. In addition to this, cocoons prepared in this manner can only be unwound in very hot water; this being requisite for effecting the separation of the threads which have not been sufficiently freed from the gum during the preliminary steeping process. Hence follows the expense of continuing the application of heat, the inconvenience of a considerable body of steam in the rooms of the manufactory, particularly in damp and cold weather; this steam preventing the drying of the silk, and giving the threads a tendency to adhere together again. Another defect attending the ordinary system of treatment is the unequal softening and tension of the threads, which in almost all cases produces an irregular, uneven, and unelastic thread. The adoption of the improved system of preparation introduced by MM. Alcan and Limet of Paris, and patented in this country for them, obviates the several defects attending the ordinary process. According to the system of these gentlemen, the cocoons are prepared regularly and uniformly to the extent necessary for obtaining the best results; the use of brooms or beaters is dispensed with, and the rupturing of the thread is rendered very rare. The cocoons may also be unwound with facility in water of a comparatively low temperature, say of 70° to 80° Fahr. The invention consists, in the first place, in submitting the cocoons successively to the action of steam, of exhaustion of the air, and of hot water. The cocoons should be first slightly softened by steeping, to facilitate the loosening of the various layers, without deteriorating them by a too prolonged action of the steam. The exhaustion of the air, which is effected by condensing the steam, is used to cause the water to penetrate to the centres of the cocoons, and when this object is attained, steam is applied for a sufficient length of time to soften the gummy matter. This steam, at the same time, expels the water from the cocoons, and dissolves out the gum from the threads, causing the cocoons to swell, and greatly facilitating the unwinding process. The annexed engraving is a vertical section of an arrangement of preparing apparatus, which may be employed for working out the improved system of treatment. A vessel, A, of copper, or other metal not easily oxidized, is imbedded in brickwork, and has a pipe, B, opening into it at the centre of its bottom, this pipe being in communication with a steam generator. In the vessel or chamber, A, is placed an inverted vessel, C, of galvanized iron, this vessel being suspended by chains or cords passing over pulleys to counterweights, and being capable of being raised or lowered at pleasure. An air-escape cock, G, is fitted to the top of the vessel, C, which is secured in position by the fastenings, H, to prevent its being raised when the steam is introduced beneath. These fastenings are fixed to rods passing to the top of the chamber, A, and fitted with handles, P, for working them by. The cocoons are placed in a basket, I, of wicker-work, wood, perforated metal, or wire-work, which is placed on the top of the perforated chamber, D, being covered by the inverted vessel, C. The whole is covered by a lid, M, to prevent the escape of steam into the apartment, the steam passing off by the pipe, T, to the outside of the building. A sufficient quantity of water to fill the vessel, C, is introduced into the vessel, A; the temperature of the water being between 100° and 180° Fahr., according to the quality and condition of the cocoons under treatment. The basket, I, filled with the cocoons in small net bags, is placed upon the double bottom, D, and the vessel, C, is lowered down and secured by the fastenings, H. The steam-cock, S, and air-cock, G, are then opened, and the vessel, C, is filled with steam, after which the cocks, G and S, are closed, and the steam becomes condensed, and produces a partial vacuum, which causes the hot water in the vessel, A, to enter into the vessel, C, and to penetrate thoroughly and uniformly through the cocoons. In order to expedite the process, a stream of cold water from the cock, K, may be made to fall upon the vessel, C, so as to cause the steam to be rapidly condensed. The steam-cock, S, is again opened, and the steam expels the water from the cocoons, and at the same time swells them by penetrating the several layers of silk. By allowing this steam to act from about five to fifteen minutes, the operation will be concluded. With some qualities of cocoons, however, it will be necessary to repeat the treatment by water and condensation, always finishing by subjecting the cocoons to the action of the steam. The preparation being completed, the cocoons in their net bags are agitated in vessels containing water heated to 100° or 120° Fahr., for the purpose of raising the external floss; this operation being always effected with great facility, and without having recourse to beaters. The outside layer of the floss adheres to the meshes of the net bag, and when the cocoons are taken out of the bags, the ends of the silk threads can be secured with great ease. The end of the thread being found, the operation of unwinding the silk may be carried on as readily in comparatively cold as in hot water; the best results being obtained with water of about 68° to 86° Fahr.



In applying this system to the retting of flax, hemp, and other similar fibrous materials, it is simply necessary to enlarge the apparatus sufficiently to enable the stalks to be introduced, and the operation may be carried on in closed vessels, if the retting requires steam of extra pressure. This process is free from the inconveniences attending the ordinary hot water and steam retting system, whilst it embraces all the advantages of that system, without unwholesome exhalations, giving the stalks a good colour, and completely freeing them from gummy or glutinous matters.

REVIEWS OF NEW BOOKS.

The Chemistry of Common Life. By James F. W. Johnston. Two vols. 8vo. Pp. 818. Edinburgh. W. Blackwood & Sons, 1854. (Second notice.)

The second and larger division of Professor Johnston's work deals more with the luxuries of life than with the first, as somewhere about half of its pages treat upon narcotics and odours. Following upon his careful dissertation on intoxicating liquors, which concluded the volume already noticed, he now gives us an elaborate chapter on tobacco, under the various artificialized forms which people of all climes have introduced as a means of multiplying their enjoyments:—

> "The aborigines of Central America rolled up the tobacco leaf, and dreamed away their lives in smoky reveries, ages before Columbus was born, or the colonists of Sir Walter Raleigh brought it within the precincts of the Elizabethan court. The coca leaf, now the comfort and strength of the Peruvian muletero, was chewed as *he* does it, in far remote times, and among the same mountains, by the Indian natives whose blood he inherits. The use of opium, of hemp, and of the betel-nut among Eastern Asiatics, mounts up to the times of most fabulous antiquity. The same probably is true of the pepper plants among the South Sea Islands and the Indian Archipelago, and of the thorn-apples used among the natives of the Andes, and on the slopes of the Himalayas; while in northern Europe the ledum and the hop, and in Siberia the narcotic fungus, have been in use from time immemorial.
>
> "As from different plants, in different parts of the world, the favourite intoxicating liquor was obtained, so from different plants the favourite narcotic was extracted by different races of men. But this important difference prevails between the two classes of indulgences, that while in all the fermented liquors, as I have said, the same alcohol or intoxicating spirit exists, each narcotic in use contains its own peculiar principle. From whatever source obtained, the fermented liquor produces nearly the same effect upon the human system. But each narcotic indulgence produces its own peculiar and special effect. Tobacco and opium, and hemp and coca, and the hop and the toad-stool, while they all exercise a narcotic influence upon the human frame, do so in a form and with modifications which in each case are peculiar, in many respects full of interest, and always worthy of deep study and consideration. These narcotic substances, therefore, occupy an important place in the chemistry and chemico-physiology of common life."

The hop—the English narcotic—and its various substitutes, is no less carefully treated, and with good reason, when we bring to our recollection that our average consumption exceeds, by some eight millions of pounds, the consumption of that universal consoler, tobacco:—

> "The yearly consumption of the hop exceeds, by two-sevenths of the whole, the home consumption of tobacco. It is the narcotic substance, therefore, of which England not only grows more and consumes more than all the world besides, but of which Englishmen consume more than they do of any other substance of the same class.

> "And who that has visited the hop-grounds of Kent and Surrey in the flowering season, will ever forget the beauty and grace of this charming plant? Climbing the tall poles, and circling them with its clasping tendrils, it hides the formality and stiffness of the tree that supports it among the exuberant profusion of its clustering flowers. Waving and drooping in easy motion with every tiny breath that stirs them, and hanging in curved wreaths from pole to pole, the hop-bines dance and glitter beneath the bright English sun—the picture of a true English vineyard, which neither the Rhine nor the Rhone can equal, and only Italy, where her vines climb the freest, can surpass."

This is a well-conceived description of the great floral ornament of the "garden of England"—a section of our island which is, perhaps, nowhere rivalled in natural fertility or in artificial richness. Five hundred pounds is no uncommon sum to be paid for a single acre of this ground; and, as Professor Johnston truly remarks—

> "The *highest* Scotch farmer—the most liberal of manure—will find himself outdone by the hop-growers of Kent and Surrey. An average expenditure of ten pounds sterling an acre for manure over a hundred acres of hops, farmed by a single individual, makes this branch of farming the most liberal, the most remarkable, and the most expensive of any in England."

On the historical management of this valuable plant, our author quotes Tusser—a poet of Henry VIII.'s time—who writes thus in his "Five Hundred Points of Good Husbaudry:"—

> "Choose soil for the hop of the rottenest mould,
> Well-doonged and wrought as a garden-plot should:
> Not far from the water (but not overflowne),
> This lesson well noted, is meet to be knowne.
>
> The sun in the south, or else southlie and west,
> Is joy to the hop as welcommed ghest;
> But wind in the north, or else northerly east,
> To hop is as ill as fray in a feast.
>
> Meet plot for a hop-yard, once found as is told,
> Make thereof account as of jewel of gold;
> Now dig it and leave it, the sun for to burne,
> And afterwards fense it, to serve for that turne.
>
> The hop for his profit I thus do exalt:
> It strengtheneth drink, and favoureth malt;
> And being well brewed, long kep it will last,
> And drawing abide, if ye draw not too fast."

Of course, in a history of narcotics, opium comes in for a large share of critical remark. All who have read De Quincey's famous "Confessions," will read with interest the plain and sober account of this drug, its history and influences, which is unfolded in the pages before us. Generally speaking, opium is little heard of with us. But what can we say on such a point in the face of actual statistics? The Rev. Mr. Clay, the indefatigable chaplain of the Preston jail, has told us that, in 1845, there were in the town of Preston alone above 1,600 families in the habit of using Godfrey's cordial, or some other equally injurious compound; and, as a practical comment upon this serious text, he adds, that in one of the burial clubs of the town, 64 per cent. of the members died under five years of age. The mothers of families work in the factories of the town; these mothers, when at work, have their children tended, or rather unattended and mismanaged by nurses, who profess to make the superintendence of children their business; and these nurses administer opium to keep their charges quiet, and thus lighten their labours. With what fatality this system of treatment is attended, Mr. Clay's statements fully explain.

In his chapter on "The poisons we select," Professor Johnston directs attention to the interesting fact of the use of that powerfully irritant poison, arsenic, as a sensual indulgence. The practice of taking small doses of arsenic is very common in Austria and Styria. Thus used, the poison gives plumpness to the figure, cleaning and softening the skin, and imparting a fresh beauty to the complexion. It also improves the breathing, and gives what is called "long-windedness," so that severe feats of climbing may be performed without difficulty. This curious custom has even penetrated to the stable:—

> "Upon animals the effects are similar to those which are produced upon man. It fattens and plumps out the horse, gives it a bright and glossy skin, and an appearance of high health and condition. Hence this use of arsenic is very common in Vienna, especially among gentlemen's grooms and coachmen. They either sprinkle a pinch of it among the oats, or they tie a piece as big as a pea in linen, and fasten it to the bit when the bridle is put into the horse's mouth. There it is gradually dissolved by the saliva, and swallowed. The sleek, round, glossy appearance of many of the first-rate coach-horses, and especially the foaming at the mouth, which is so much admired, is owing to the arsenic they get. In mountainous districts also, where horses have to drag heavy burdens up steep places, the drivers often put a dose of arsenic into the last portion of food they give them. This practice may be continued for years, with horses as with men, without the least injury; but if a horse which is used to it comes into the possession of one who does not give arsenic, it loses flesh and spirits, and its strength sensibly diminishes. In this state the most nutriitous food is unable to restore the animal to its former appearance; but a few pinches of arsenic speedily bring it round again."

"What we breathe and breathe for," is a chapter which gives very readable information on a subject ordinarily considered abstruse and uninviting. The general reader will find his time to be not unprofitably bestowed, if he considers well what is here said on this never-ending action of the animal frame.

We need say no more to convince even superficial thinkers that the two volumes, through which we have just passed, are grateful reservoirs of information. The getting up of the work, too, is worthy of the Edinburgh press—ably seconded, as it is, by illustrative wood engravings, in quality far above even the high average of the time in which we write.

Reports of Cases relating to Letters Patent for Inventions, decided in the Courts of Law and Equity. By Edmund Macrory, Esq. Part I. Benning. London: 1855.

The advantages attendant upon a division of labour in ordinary mechanical operations, become very greatly increased as the character of the labour rises in importance. A very few years ago, all cases which were any way noticed in print were jumbled together in amusing perplexity. When we say that this was the case but a few years ago, we might almost say, indeed, that up to the present time the same, as a general rule, has taken place. A reporter has, strangely enough, considered himself qualified to judge of facts and reasoning, necessarily in a large measure out of the curriculum of his own learning. However, some little diffidence *has* been experienced in so attempting to treat such grave matters, and the press has issued rather dry transcripts of shorthand writers' notes (which can never properly, in a literary point of view, be given in *extenso*), instead of facts and arguments wrapped up in language adequate to exhibit the case, the *pro* and *con* in favour of or against either of the parties, and the luminous judgments delivered. We are rejoiced to find a labourer in the more satisfactory mode of doing these things. We have here a gentleman bringing to bear upon his subject considerable learning and a sagacious judgment,—the subject itself being treated in at once a thoroughly practical and as philosophic a method as it is capable of. The five rather important cases on Harrison's, Tetley's, Bateman & Moore's, Cutler's, and Bush's patents, respectively, are all here reported at full length, elegantly printed, and at a very moderate price. It is necessarily accompanied, in some cases, with wood engravings, which we are glad to see are executed in the best manner. These reports are intended to comprise cases decided by the Judicial Committee of the Privy Council, and notes of applications for amendments, leave to enter disclaimers, &c. &c., which will render the work one of great utility to the profession at large, to the patent agent, and to the inventor.

The Permanent Way Company's Circular. London: October, 1854.

This handsome volume, of twenty-four large pages of letterpress, and ten elaborate plates of still greater size, is issued as an exposition of the objects of an association of some fifteen patentees of railway improvements, combined for the purpose of the better introduction of really good inventions into practical use. This union of interests came to be determined on, firstly, "because it would enable companies to use two or three of the improvements combined, without having to deal with separate patentees; and, secondly, because it liberated them, as professional men, from the bias of interest in any particular patent." Accordingly, we have in this volume illustrated descriptions and calculations of costs of the various plans of "fish-jointing"—the great modern improvement in permanent way—timber-bedded through sleepers, cast-iron sleepers, and broad flanged rails, all of which are worked out by the company as a single invention. The project appears to be a wise one, and its promoters have taken a proper view of the necessities of their case, in issuing so good and clear a statement of their plans, as is contained in the elegant volume answering as their circular.

CORRESPONDENCE.

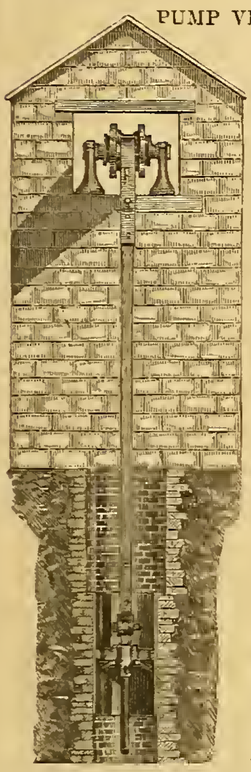
ARCHED BULKHEADS FOR IRON STEAMERS.

In the disasters which have happened to steamers during the past year, you cannot have failed to notice that the bulkheads, constituting the water-tight compartments, have usually burst at the very and only time when their services were needed. This may have led to a doubt as to whether they might be depended upon at all as a means of safety, in case the vessel should be stove and one of her compartments filled. But looking at their present system of construction, that is, a flat surface nearly unsupported in a fore and aft direction, it is a wonder that they have in any case been able to withstand the pressure of a column of water equal to the vessel's immersion when laden, increased by the filling of a compartment, aggravated, too, by the pitching motion of the vessel.

To make the bulkheads strong enough to withstand the pressure and motion of the water, I suggest that they should be shaped to the form of an arch, springing from the sides across the vessel. They may be made with either the convex or concave side towards the bow, but the former arrangement is to be preferred, as the vessel is most liable to receive injury forward, and the pressure of the water on that side cannot force the bulkhead out of shape.

March, 1855. KENNETH.

PUMP VENTILATOR FOR MINES.



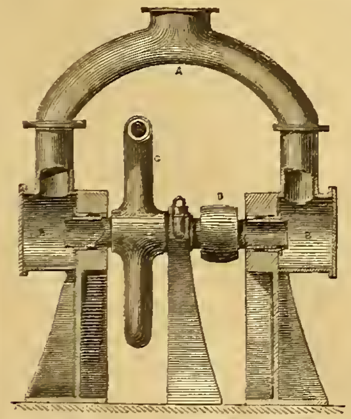
The more satisfactory ventilation of subterranean workings has latterly become a subject of great anxiety to some of the first practical engineers of the day; and as the field of suggestive inquiry is so wide, I shall be glad to see what I have to propose in the pages of the *Practical Mechanic's Journal.* My sketch represents the upper part of a mine shaft, with the engine-house and engine overhead. In the upper part of the shaft is fitted a bored cylinder of the same diameter as the shaft. This cylinder is fitted with a valved piston, carried upon the main pump rod, and consequently worked by it. The valves in the piston open downwards, so that when the engine comes in-doors the valves open; and on the engine going out again they shut, thus forcing pure air down the shaft.

In adopting this plan in the way here suggested, the engine must work faster than pumping engines usually do, so that the valves may be really closed.

Hayle, March, 1855. J. BARNES.

HYDROSTATIC MOTIVE-POWER ENGINES.

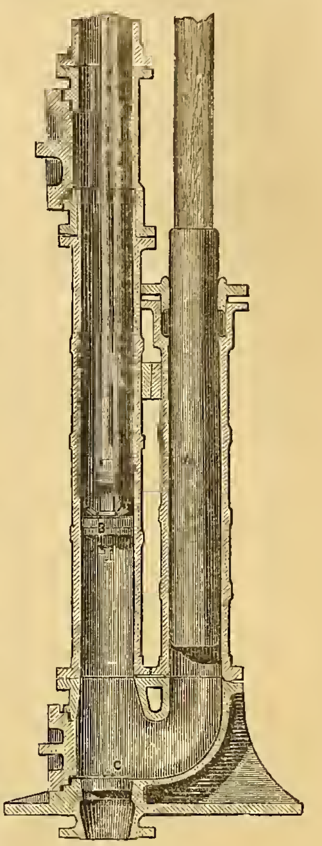
Considerable power is derivable from a Barker's mill, but, from some hitherto unknown cause, as beneficial a result has never been obtained from it as from an equal expenditure of water in other machines. I conceive that this description of engine has thus failed to realize theoretical expectations regarding it, on account of a serious defect in the construction. In an ordinary Barker's mill, the water is admitted to the centre of the wheel at one side only; consequently, as the pressure due to the fall of water exerts itself in all directions within the wheel, and the ducts leading to it, it follows that there will be an unbalanced pressure tending to force the wheel away from the duct, and causing immense pressure and friction against the bearings on the opposite side of the wheel to that at which the water enters. When the cause of the defect is explained, the remedy at once suggests itself, and consists in introducing the water to the wheel at both sides. An arrangement for carrying out this improvement, which has lately been patented by me, is represented in the accompanying engraving. Here the water is conducted to the apparatus by a pipe, A, which branches off to two boxes, B. These boxes are on opposite sides of the wheel, C, which revolves in a vertical plane. The shaft of the wheel is hollow from end to end, and its opposite ends are entered through stuffing-boxes into the boxes, B, and the water enters into the body of the wheel in equal quantities from each side, so that there is no lateral pressure whatever on the bearings, and the wheel is enabled to give off its full power, which is communicated to the machinery to be driven by means of the pulley, D. The wheel, C, here represented is of the simplest kind, being composed of two hollow curved arms, from the ends of which the water is ejected, causing the wheel to revolve. The improvement is, however, obviously applicable to various descriptions of turbines and other hydrostatic motive-power engines.



Dulwich, February, 1855. C. TETLEY.

COMBINED FORCING AND LIFTING PUMP.

The annexed sketch represents a combined forcing and lifting pump for draining mines. I have not seen a similar arrangement before, and as it may be useful in many situations, perhaps you will give it a place in your *Journal.*



It requires little explanation. The plunger, A, and the bucket, B, are both connected to the same end of the engine beam, and they rise and fall together. The bucket rods are in the inside of the rising column of pipes; the clack, C, is common to both. When the plunger, A, with its bucket, B, ascends, the water flowing through the clack, C, follows A and B. In descending, the clack, C, shuts, and the water displaced by the plunger flows through the bucket lids, which are open. In the next ascent, the bucket discharges its quantity of water, so that the flow of water is continuous, and we have thus a forcing pump and a lifting pump working from the same power, with only one clack between them.

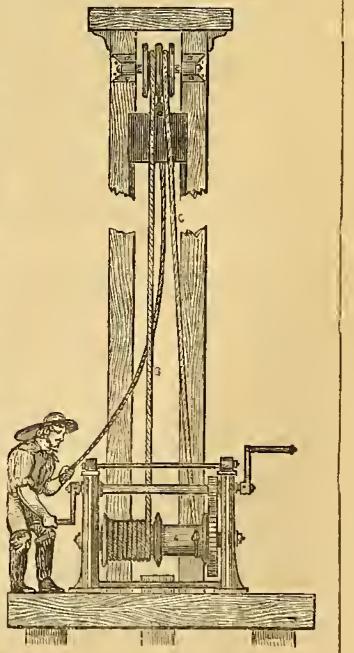
Many modifications of the same principle will suggest themselves. For example, the bucket rod may work through a stuffing-box, and be attached to the same dry rods to which the plunger is attached; and this is particularly applicable to lying pumps, where the rods are always carried outside of the pipes, and work the bucket through a stuffing-box.

An objection to the plan is the extra friction of the water passing through the bucket lids, when both the bucket and plunger are of the same diameter. This may apply when the velocity of the current exceeds 80 feet per minute, but at a less velocity the friction is not much felt, and there are few of the pumps worked with bell cranks at this speed.

Glasgow, March, 1855. RALPH MOORE.

SIMPLE CONTINUOUS-ACTION PILE DRIVER.

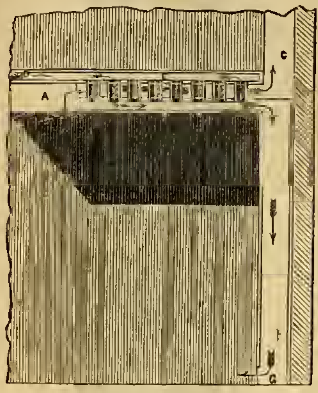
On seeing in the *Practical Mechanic's Journal* for January a description of Mr. Bower's Pile Driver, a plan of my own for effecting a similar purpose was brought to my recollection. This plan, which occurred to me as far back as 1843, is represented in the accompanying sketch. The hoisting apparatus consists of an ordinary crab-winch, A, to which are connected two hoisting ropes, B, C, so arranged that, when one is being wound upon the barrel, the other is being given off, so that its hook may be ready for attachment to the weight the moment this falls. The central flange in the overhead pulley may be made loose, to enable the rope, which may at the moment be lifting the weight, to adjust itself over the centre of the latter, so as to avoid lateral strain and friction on the pulley. In small works, where the expense of steam power cannot be afforded, this plan would be found most convenient and economical on account of its great simplicity, and the facility with which the necessary details can be obtained and arranged.



Cheltenham, Feb. 1855. B. MITFORD

HOUSE VENTILATION.

The accompanying sketch represents a plan of house ventilation, which I have devised on the principle of the well-known respirator. The sketch represents a vertical section through the wall and ceiling of a room. The vitiated and heated air passes off through the opening, A, in the ceiling, and traverses a chamber, B, finally escaping up the duct, C. The fresh cold air enters through the duct, D, to a space, E, above the chamber, B, and this space, E, communicates with a similar space below, by means of a series of thin metal tubes passing through the chamber, B. The heated air passing out will communicate some of its heat to the tubes, and these again will transfer it to the incoming fresh air, so that some of the heat will be economised. The current of fresh air pursues its course down the duct in the side wall, and enters the room at G.



This system of ventilation seems more especially applicable to ships. It is also suitable for churches, court-houses, and other places where public meetings are held.

Tyddyn, Mold. February, 1855. C. Butler Clough.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTE OF CIVIL ENGINEERS.

January 23, 1855.

Discussion on Mr. Rennie's paper, "On the Construction of the Sea Embankment across the Estuaries of the Kent and Leven, in Morecambe Bay, for the Ulverston and Lancaster Railway," by Mr. J. Brunlees.

The early projects of the late Mr. George Stephenson and Mr. J. Hague, for embanking and reclaiming Morecambe Bay, were first noticed; other railway and embanking works, originally projected by Mr. J. R. M'Clean, were also alluded to; those which formed the subject of the paper, and were now being executed by the author for a company, though very different in direction and in system to the two first designs, were nearly identical with those of Mr. M'Clean, and all had for object to carry a line of railway across part of the Bay, and by its means eventually to reclaim large tracts of land for agricultural purposes. The lines to be connected were the Furness and West Coast Railways with Lancaster and the South. The principal works were on the estuaries of the Kent and the Leven, with the view of fixing the hitherto unstable fresh-water channels of those streams, so as to facilitate the eventual reclaiming a considerable portion of the Bay.

The works were commenced in May, 1853, and in spite of great difficulties had made considerable progress. The embankments were formed of the calcareous sands as hearting, covered on the sea slopes by a layer of well-prepared clay puddle, upon which was deposited a depth of 18 inches of small quarry-rubbish, locally termed "quarry-rid," and then faced with pitching composed of limestones 15 inches deep, varying from 8 inches to 16 inches in width; the slopes thus formed stood well at 1½ to 1, and 2 to 1, and after a time, when the material became consolidated, no water could pass through the embankments. The height varied considerably, being in some portions as much as 15 feet 6 inches above high water of ordinary spring tides, and 4 feet 3 inches above the highest tide ever remembered on that part of the coast.

In consequence of the high price of labour, carts, with two wheels, were substituted for wheelbarrows, in forming the embankments, taking care to carry on only such lengths as could be raised to a safe height, puddled and pitched between spring tides, the open end of each length being laid to a flat inclination, up which the material for topping off could be carted; that end being protected during spring tides by clay and stones; about ten or eleven lineal yards could thus be formed per day, or at the rate of a mile in six months, from one face.

Details were also given of the construction of the low stone weirs, formed for the purpose of preventing the "bracking," or shifting of the channel of the streams, under which as much as 60,000 tons of sand had been moved in the course of one tide.

Although it was not probable that the force exerted by the waters in Morecambe Bay would ever equal that of the waves of the German Ocean, which had been shown, by the experimental marine dynamometer of Mr. David Stevenson, to be equal to 1½ ton per square foot, the author assumed that as a standard, and constructed the embankments to withstand double that force; at the same time, he adopted regular slopes of 1½ to 1, and of 2 to 1, in preference to the concave form, as he had in various localities seen prejudicial effects arise from the use of that section; as the waves were forced up the flat part of the slope with great velocity, then accumulating on the more abrupt part, they curled over, and in the recoil fell with such force on the pitching as to loosen the stones and allow them to be drawn out by the undertow, or retreat of the wave.

Numerous experiments were tried for determining the force required to draw bricks out of slopes four feet high, built at various angles. The following were the average results:—

Ratio of slope.	Weight in lbs. required to extract the centre brick.	Height of slope.
1 to 1	105 lbs.	4 feet.
2 " 1	148 "	4 "
3 " 1	144 "	4 "
4 " 1	98 "	4 "

The weight was applied direct to the brick by a chain passing over a pulley, and increased gradually.

The viaducts over the river channels were intended to be built of timber, founded upon Mitchell's screw piles, each structure consisting of fifty spans of thirty feet each, with a drawbridge at the channel with an opening of thirty-six feet span, a model of which was exhibited.

January 30.

"Description of the Iron Roof in one Span, over the Joint Railway Station, New Street, Birmingham," by Mr. J. Phillips.

February 27.

"On Steam and Sailing Colliers, and the various modes of Ballasting," by Mr. E. E. Allen.

March 6, 13, and 20.

Discussion on Mr. Allen's paper.

"On the application of the Screw Propeller to the larger class of Sailing Ships for long voyages," by Mr. R. A. Robinson.

ROYAL SCOTTISH SOCIETY OF ARTS.

Nov. 13, 1854.

The annual general meeting was held this evening, by an address from the President, the Rev. Prof. Kelland.

This was followed by "An Exposition of the Arts, Manufactures, and Social Condition of Turkey," by Edward Lang, Esq.

The following Report of the Prize Committee, awarding the prizes for Session 1853-4, was then read, and the prizes were delivered by the President to the successful candidates:—1. To Thomas Stevenson, Esq., Civil Engineer, Edinburgh, —for his "Description and Drawings of Dipping and Apparent Lights for Sunk Reefs and Pier-heads of Harbours."—The Society's Gold Medal, value Ten Sovereigns. 2. To James Elliot, Esq., Teacher of Mathematics, Edinburgh,—for his "Mechanical Illustrations of the Planetary Motions," including an Illustration of his Theory of the Stability of Equilibrium of Saturn's Ring.—The Society's Silver Medal, value Ten Sovereigns. 3. To Robert Henry Bow, Esq., C.E., Edinburgh,—for his "Description of New Designs for Iron Roofs, of great clear Span," &c., with Drawings.—The Society's Silver Medal, value Ten Sovereigns. 4. To William Swan, Esq., Teacher of Mathematics, Edinburgh,—for Description of his "Simple Variation Compass."—The Society's Silver Medal, value Five Sovereigns. 5. To John Scott, Esq., Teacher of Mathematics, Edinburgh,—for his paper "On New Properties, and applications of Spiral Pumps, &c., with Models and Diagrams."—The Society's Silver Medal, value Five Sovereigns. 6. To Mr. George Mitchell, 101 High Street, Edinburgh,—for his Description of a "Safe Lock, incapable of being opened by any other means than by its own key." —The Society's Silver Medal, value Five Sovereigns. 7. To the Rev. James Brodie, Monimail, Fife,—for his "Inquiry into the Principles on which the action of Sails and Rudders depends, with Diagrams."—The Society's Silver Medal. 8. To J. T. Thomson, Esq., Civil Engineer and Government Surveyor at Singapore, for his Description and Drawing of a "Semi-Revolving Light for Lighthouses."— The Society's Silver Medal. 9. To Thomas Rodger, jun., Esq., St. Andrews,— for his paper "On Collodion Calotype," with Illustrative Specimens.—The Society's Silver Medal. 10. To Alexander Melville Bell, Esq., Teacher of Elocution, Edinburgh,—for his paper on a "New Principle of Stenography, or Shorthand Writing."—The Society's Silver Medal. 11. To Mr. Thomas Steven, Builder, Bonnyrig, Lasswade,—for his Description of a "New Method of Shutting Doors," with a Model.—The Society's Silver Medal. The Committee have also recommended the Model to be purchased for the Museum. The *special thanks* of the Society were given to the following gentlemen, viz.:—1. To Charles Cowan, Esq., M.P., —for his oral "Sketch of the various changes and improvements which have taken place in the Manufacture of Paper during the last thirty years," with copious Illustrations. 2. To Andrew Fyfe, M.D., Professor of Chemistry, King's College, Aberdeen,—for his communication "On the Chemical Constitution of Coal," and on the question, "Is Torbane Mineral a Coal?" 3. To George Buist, LL.D., Bombay,—for his oral "Account of some of the East Indian Arts and Manufactures, with specimens of the Tools and Manufactured Articles." 4. To J. Stenhouse, M.D., London, — for the "Description of his Charcoal Respirator, for breathing without danger infectious atmospheres, with an account of his recent Researches into the Deodorizing and Disinfectant Properties of Charcoal." 5. To George Wilson, M.D., Lecturer on Chemistry, Edinburgh,—for his "Communication on the Prevalence of Colour-Blindness, or Chromato-Pseudopsis, and on the limit which it puts to the use of Coloured Signals on Railways, at Sea, and elsewhere," and "on the Use of Yellow Eye-Glasses, to assist the vision of the Colour-Blind by Daylight." Dr. Wilson being engaged in making still farther investigations on this subject, a farther grant, not exceeding ten pounds, to assist in defraying the expense of the prosecution of his important researches, was made to him by the Committee, till the investigations be completed. 6. To James Alexander, Esq., Wine Merchant, Edinburgh,—for his "Suggestions for a Simple System of Decimal Notation and Currency, after the Portuguese Model." 7. To Mr. John Wilson, 47 Portugal Street, Glasgow,—for his "Description of a Method of preventing Water-Cocks from Bursting during Frost." The Committee regretted that there had been no communication read during the past Session, to which it seemed proper to award the Keith Prize of Thirty Sovereigns.

NOVEMBER 27.

"On a Tool-holder, particularly applicable to the Screwing Lathe," by Mr. G. Taylor, of the Imperial Mint, Constantinople.

"On a Chronofore, or Improved Hack-watch, for minutely Subdividing a Second," by Mr. E. Sang. The author stated that this instrument, which he calls a chronofore, or time-carrier, is intended to be used in the comparison of clocks and chronometers with each other. Every one who has tried to compare two chronometers must have felt the difficulty of estimating that fraction of the beat by which the one may be in advance of the other; and that the nearest half second is almost the limit of our power. In order, then, to obtain the rate of the chronometer, we are compelled to allow it to go on for a considerable time, even for several days, and after all it is only the average rate for that time which is got. The mode of comparison proposed by the author is, to use an intermediate watch, or rather chronometer, and to compare this with each of the time-keepers, whose relative rates are to be observed; and to arrange the beats of this intermediate or hack-watch, so as to allow of comparison to a minute fraction of a second. For this purpose, the hack-watch is constructed to make one beat per minute more or less than the usual number of beats—say 119 in place of 120 beats. In this way we are able, just as with the Vernier and scale, to compare the position in time of our watch with that of the chronometer; and comparing it again with a second chronometer, we get the difference between the two, true to the 238th part of a second, if the ear can go to that nicety, or, otherwise, to the utmost degree of precision to which the ear can attain. When the chronofore is compared with a clock beating whole seconds, the accuracy attainable by it is only the 119th part of a second; but even this precision is at the very limit of the delicacy of the ear. It was remarked, that by this method there would be much saving of time in rating ships' chronometers—a thing of vast consequence both to the royal and mercantile navy.

"On a Boring Machine for Blasting Rocks," by Mr. Hugh Cleland, Craigleith.

"On an Improvement on the Thrashing Mill," by Mr. G. Johnston, Craigleith Hill House.

DECEMBER 11.

"An Exposition of the Arts, Manufactures, and Social Condition of Turkey," Part II., by Mr. E. Sang.

"On a Smokeless Furnace," by Mr. R. H. Bow, C.E.

"On the Antipodal Land of the Globe, its Positions, and its Proportion to the whole Land of the Earth's Surface," by Mr. James Gardner.

"Projects for the Introduction of a New Species of Fuel, and a New Species of Manure," by Col. Graham Graham.

JANUARY 8, 1855.

"On the Combinations of Colour and Form for Railway and Ship Signals, best fitted to guard against their being mistaken by the Subjects of Colour-Blindness," by George Wilson, M.D.

"On an Instrument for taking the Density of Floating Bodies," by Mr. Peter Stevenson.

Mr. William Hart exhibited in action his Improved Medical Galvanic Battery.

JANUARY 22.

A Letter from W. J. M. Rankine, on the part of a Committee of the Royal Society of London, relative to Space being reserved by the Board of Trade for Astronomical and Philosophical Instruments until the end of January.

"A Short Sketch of the Rise and Progress of the Royal Steam Navy, with a few practical suggestions growing out of fourteen years' experience in her Majesty's service," by James Spence, chief foreman of the Steam Factory at Portsmouth Dockyard.

"On a New Form of the Platometer, an Instrument for ascertaining the Area of Plane Surfaces," by James Clerk Maxwell, Esq., Trinity College, Cambridge.

"On a Simple Compressible Siphon," by A. Bryson. This apparatus appears to be precisely similar to what has already been simultaneously invented by two different people—Mr. Coffey and Professor Lovel.—(See page 148, vol. 6, *P. M. Journal.*)

FEBRUARY 12.

"On Writing Inks," by Dr. Stark.

FEBRUARY 26.

"On a Railway Lighthouse Signal," by Mr. A. Carrick, Glasgow.

"On the Strength of Screw Propeller Blades, and an Instrument for measuring the pitch, and proving the correct form of Screw Propellers, called a Pitch Compass," by Mr. James Spence, Portsmouth.

SOCIETY OF ARTS.

DECEMBER 6.

"On British Agriculture, with some Account of his own Operations at Tiptree Hall Farm," by Mr. I. J. Mechi. This is the fourth annual statement of the results of his experience, which Mr. Mechi has laid before the society. The balance-sheet was again highly satisfactory and remunerative, showing an advantage in rent and profit of about £750 on 170 acres. While he ventured to assert, from his own experience, that we could grow more than all the food that was required by the British people, he stated that it could only be done by investment and improvement. He urged the employment of town capital in this manner, rather than that the cash boxes of our capitalists should be filled with bonds and responsibilities from every foreign nation and foreign undertakings. He predicted that, in a comparatively short period, every farmery would have sufficient shelter for its stock, lighted with gas, its fixed steam-engine, economising the costly labour of horses, and warming, by its waste steam, the various sheds. It was a great point to provoke people to *talk* about such matters; causing, first, a little wonder, anger, disbelief, inquiry, and ultimate calculations and conviction. He attached much importance to the application of our town sewage to agricultural fructifications. In order to form some idea of the extent to which our food might be increased by the application of town sewage, it might be considered that 300 sheep on a farm of 100 acres would keep it in a high state of fertility, and that, therefore, reckoning 450 men, women, and children as equivalent to 300 sheep, our population would fertilize 500,000 additional acres. Among the coming improvements in agriculture, was that of cultivation by steam. On public grounds, he had expended some money in the construction of Mr. Romaine's machine. It had, however, only been partially successful; there was too much velocity and too little steam. The art of raising the soil must evidently be by a slow motion. Enough was shown to prove that it will soon be the order of the day, particularly as the Royal Agricultural Society of England have lately very properly offered a premium of £200 for such a machine. This was a point of the greatest importance, as he was prepared to prove that farm horses consumed the produce of nearly one-fourth of the arable land of the country. He hoped that, as agricultural statistics were now becoming favourable, we should soon be furnished with such comprehensive details as to enable sound conclusions to be drawn in every branch of British agriculture. At present few farmers kept books, and therefore it was impossible to arrive at anything like a correct estimate of their farming. To those who might be induced to enter upon farming as a business, he would say that, generally, to farm 400 acres of land, you should have at least £5000, or £12 per acre. As a general rule, ten per cent. on the capital invested was considered a very good profit, for farming, though an agreeable occupation, was notoriously a slow business, attended with comparatively small profits. Amongst the evidences of enlightenment and improvement of the present day, was the introduction of covered homesteads, or farmyards, where the animals and manure were both sheltered from adverse weather. Live stock, however, he considered were necessary evils, mere manufacturers of manure, and unattended with any direct profit. He had arrived at this conclusion from extensive stock feeding.

An animated discussion followed the reading of the paper, and was sustained by Messrs. S. Sidney, Oakley, Moore, J. C. Morton, E. Davies, James Caird, Colonel Challoner, C. W. Hoskyns, and the Chairman. The chief points of the debate were on the relative merits of solid and liquid manure, and on the application of steam to agriculture. In regard to the former, it was considered by some that though liquid manure was very beneficial for grass crops, yet for grain and root crops it was injurious. It was also thought that the great bulk of town sewage would prove an obstacle to its extended use, and that as much of the land of England, especially in the western parts of the country, was already so far saturated with water that it was difficult of drainage, it would be injudicious to increase the amount of water by using liquid manure. On the other hand, it was asserted that liquid manure was especially useful in the summer, and in seasons of drought—that it must be borne in mind that, in the case of town sewage at least, it was already in a liquid form—that to reduce it to the solid form must involve a considerable expenditure, and that after all it might be necessary to apply it in a liquid state.

JANUARY 17, 1855.

"On the Smoke Nuisance, considered Morally, Historically, Scientifically, and Practically," by G. W. Muir.

JANUARY 24.

"On Peat and other Vegetable Charcoal, and some of its uses," by Mr. W. Longmaid.

FEBRUARY 7.

"On the Commercial Consideration of the Silk-Worm and its Products," by Mr. Thomas Dickins.

FEBRUARY 14.

"On the Expediency of at once Decimalizing English Moneys and Weights," by Mr. J. A. Franklin.

SPECIAL PRIZES.

In addition to the General Premium List, the Council has determined to offer Special Prizes as follows:—

For two pounds of the best and finest Flax Thread, spun by machinery, suitable for lace-making. Twenty-five pounds, or a Gold Medal of the same value. The Committee of the Normal Lace School of Ireland will be requested to report on the specimens submitted.

For the best Essay on the Means of Preventing the Nuisance of Smoke arising from fires and furnaces; treating the subject practically, reviewing the various plans which have been put forth as remedies, with the experience of their success or failure, and the results of their adoption as to expense or economy in erection and in working. The legislative measures necessary for the prevention of the nuisance, and the causes of the failure of the local acts for its suppression, should also form part of the Essay. Twenty-five pounds, or a Gold Medal of the same value.

The two foregoing prizes of £25 each, have been placed by Benjamin Oliviera, Esq., M.P., at the disposal of the Council for Premiums during the year 1855.

For a Composition for the feeding rollers used in printing paper-hangings by cylinder machinery, similar in consistency and action to those used in letterpress printing, but adapted for working in water colours. The Society's Medal and Five pounds. This premium has been placed at the disposal of the Council by S. M. Hubert, Esq.

For a "School" Microscope, to be sold to the public at a price not exceeding 10s. 6d The Society's Medal.

To be a simple microscope, furnished with powers as low as those of a pocket-magnifier, for the purpose of observing flowers, insects, &c., without dissection. The lenses should range from two inches to one-eighth of an inch; the focal adjustment to be by rack-work, extending sufficiently above the stage to allow a thick object to be brought under the lowest power. It should be furnished with plyers, a concave mirror, and an illuminating lens; also a live box, or, instead of it, two or three glass cells of different depths, a few slips of common glass, and a few pieces of thin glass for covers.

FEBRUARY 28.

"On the Iron Industry of the United States," by Professor John Wilson.

MARCH 7.

"On the Sewage of London," by Mr. J. B. Lawes.

MARCH 14.

"On a new method of teaching Drawing, involving the principle of a new system of Architecture," by Herr Joseph Kumpa, of Dresden.

MECHANICAL ENGINEERS.

BIRMINGHAM, NOV. 1, 1854.

"On Prideaux' Self-closing Valve for preventing Smoke in Steam Boiler and other Furnaces," by Mr. J. E. Hodgkin.

"On an improved Wrought-iron Piston," by Mr. J. E. M'Connell.

"On an improved Boiler," by Mr. H. Wright.

"On an improved Friction Hammer," by Mr. J. Kitson.

MONTHLY NOTES.

MARINE MEMORANDA.—PROGRESS OF SCREW PROPULSION.—The great combined screw and paddle steamer of the Eastern Steam Navigation Company, like many other great works, has proved to be a tougher job than was originally expected. The vessel was intended to have been ready by next September, but it now appears that the close of the year will hardly see it completed. At the present time, the whole of the main bulkheads, forming the 60-feet compartments, and the longitudinal bulkheads, together with the 40-feet and partial bulkheads, constituting the framing of the middle body, or nearly 400 feet in length of the ship, have been completed, and the plating of the inner skin of the ship is commenced, and already forms a very considerable extent of cover, under shelter of which the longitudinal ribs and the outer skin can be proceeded with in all weathers. The cylinders are bored, and the chief part of the castings are finished. The great size of the hull was against the ordinary system of launching, or the building in a dry dock and subsequent floating out, as is sometimes practised. To launch such a structure in the usual way, where the inclination of the keel must be 1 in 12 or 15, to insure sliding off the ways, would have involved the elevation of the forefoot some 40 feet in the air, and the forecastle would actually have been 100 feet from the ground, whilst the whole vessel would have been, on an average, some 25 feet higher than if built on an even keel. But in these large structures there is an evil of still greater magnitude, as affecting longitudinal launching, and this is the great extent of the vessel, which must be borne up by the water long before the bow can reach the water's edge. Mr. Brunel has, therefore, built his vessel with its keel parallel with the river-side, in such a position that the inclined plane may be easily made at the proper angle, to take her safely down into the water. In constructing the foundation of the floor on which the ship is being built, provision is made at two points to insure sufficient strength to bear the whole weight of the ship when completed. At these two points, when the launching has to be effected, two cradles will be introduced, and the whole will probably be lowered down gradually to low water-mark; whence, on the ensuing tide, the vessel will be floated off. The operation may thus be performed as slowly as may be found convenient, or if, upon further consideration, launching should be thought preferable, it may be adopted. The whole of the vessel is divided transversely into 10 separate perfectly water-tight compartments, by bulkheads carried up to the upper deck, and, consequently, far above the deepest water-lines, even if the ship were waterlogged, so far as such a ship could be; and these being not nominal divisions, but complete substantial bulkheads, water-tight, and of strength sufficient to bear the pressure of the water, should a compartment be even filled with water, if the ship were supposed to be cut in two, the separate portions would float safely; and no damage, however great, to the ship's botttom, in one or even two of these compartments, would endanger the floating of the whole, or even damage the cargo in the rest of the ship, or above the main-decks of the compartment in question; and all damageable cargo would be stowed above that deck. Besides these principal bulkheads, there is in each compartment a second intermediate bulkhead, forming a coal-bunker, and carried up to the main-deck, and which can on an emergency be closed. There are no openings under the deep-water line through the principal bulkheads, except one continuous gallery or pipe near the water-line through which the steam-pipes pass, and which will be so constructed as to remain closed—the opening being the exception, and the closing again being easy; and the height being such that, under the most improbable circumstances of damage to the ship, ample time would be afforded to close it leisurely, and to make it perfectly water-tight. The whole of the vessel, except the extreme stem and stern, the whole buoyancy of which is comparatively unimportant, from the fineness of the lines, up to a height considerably above the deepest water-line, is formed with a double skin, with an intervening space of about three feet. The material is disposed longitudinally, giving to the whole much greater strength, with the same amount of material; but one of the most important results has been the great increased security attained, as the outer skin may be torn or rent against a rock without causing the ship to leak. The space between these two skins is divided by longitudinal beams, and the principal bulkheads into some fifty separate water-tight compartments, any one or more of which may be allowed to fill without materially affecting the immersion of the ship. A statement of the pecuniary transactions of the company will best convey an idea of the vast engagements into which the promoters have entered, in reference to this great naval structure. The total amount of money received is £187,568. Of this, the charter of incorporation, deed of settlement, parliamentary, law, interest, engineering, and general charges, have taken £9,421, and the contractors have received £165,246.

Our "Navy Estimates," always a serious matter for contemplation, amount for the ensuing year to the vast amount of close upon sixteen millions sterling. This includes the great item of "Transport Service,"—a service which recent revelations prove to have been conducted on the most expensive and improvident system. The naval costs proper are ten millions and a half. Amongst the sums making up this aggregate, are half a million for steamers' fuel, £650,000 for steam machinery, and £350,000 for new vessels. Besides these, there is the novel feature of a screw steamer for the Emperor of Japan, a present costing the country £10,000.

AMERICAN FIRE ALARM TELEGRAPH.—This telegraph, which has been in operation in the city of Boston for more than two years, consists essentially of two parts: first, *the signal apparatus and wires*, by which the intelligence of a fire is communicated from any part of the city to the central station. Second, *the alarm apparatus and wires*, by which the alarm bells in different parts of the city are struck from the central station by the touch of a single finger, without the intervention of hands, watchmen, or bellringers at the belfries or bell towers. In the city of Boston there are forty-three stations, or "*signal boxes*," from any one of which the intelligence of a fire in the neighbourhood can be communicated instantly to the central station, by the simple turning of a crank. The operator at the central station—the sole watchman of the system—is then able, by simply depressing a key with his finger, to strike the district number simultaneously on twenty-two church, school-house, and engine bells in every quarter of the city; and not only this, but also to tap back on all the signal boxes the number of the signal box in the district from which the alarm proceeded. The time between the first discovery of a fire by the inmates of a dwelling, and its definite announcement from all the steeples, and by all the signal boxes, is thus, on an average, not more than three minutes, and is often within a single minute. The wires connected with the signallizing and alarm apparatus, forming the "signal circuits," and "alarm circuits," are carried over the houses, on the highest and most isolated of which they are supported by insulators held in brackets. There are always duplicate wires, following different routes, between every two stations, so that if one is broken from any cause, the second remains good until the first can be repaired. The ground is not used as any part of the circuit, so that the falling of a wire produces no false connection, and double insulation also results. These precautions are found to preserve the circuits practically intact. The central station is furnished with testing apparatus, by which the integrity of each circuit is constantly ascertained. For convenience and security, the signal boxes and the alarm bells are not strung respectively upon one great signal circuit, and one great alarm circuit, but the number of circuits of each class is multiplied, all of them radiating from the central station. Thus a signal circuit may traverse the north part of a city, and be connected with eight or ten signal boxes, another the south part, &c. An alarm circuit may also extend north, or in any direction, and embrace one, two—five bell towers, as the case may be, and so on. The operation of these circuits are all, however, connected at the central station, so that any signal box can communicate its intelligence to the centre, and all the bells on the various circuits can be struck at once, if desired, from the centre. The system is called into operation, in case of fire, by applying to the nearest "*signal box.*" The signal box itself is a solid, cast-iron, cottage-shaped box, attached to the side of a house, opposite a gas lamp, and communicating by wires, enclosed in a wrought-iron pipe, with the signal circuit overhead. The box is locked, but a sign tells where the key may be found; or a police officer or watchman can furnish a key. On opening the door, a *crank* is seen within. On turning this, the number, not only of the district, but of the box itself, is instantly communicated to the central station, and the longer the crank is turned, the more repetitious of the same signals are given. These signals are received and recorded at the central station by a register, at the same time that a call or office alarm bell is struck to give notice to the operator. We may suppose that the fire is signalized from station or box *five*, in district *three*. The operator at the centre, on seeing the record, turns immediately to the "*district keyboard*," and presses down a key marked 3. The mechanism of the keyboard starts at once, and by telegraphic communication, causes the alarm bells in the bell towers to strike the district number *three*, and to continue to do so as long as the key is held down. This is accomplished by machinery in the bell towers, liberated at each blow by a telegraphic impulse, communicated at suitable intervals by the arrangement of the keyboard. But suppose the operator only wants to ring a part of the alarm bells; by a "*switch*," he disconnects one or more of the alarm circuits from the district keyboard, and the corresponding bells are silent. But while the operator is holding down the key of district *three*, and the telegraphic mechanism is doing all the rest of the work on the bells, he turns to one or more finger keys which communicate back with the signal boxes, and taps on these occasionally *five* times; a little magnet and armature in each signal box gives a sharp click for every tap, and the firemen, who run to the nearest box and listen, know that the alarm comes from district *three*, station *five*. The machinery in the bell towers consists of a striking machine, carried by the water in the city pipes, or by weight, and let off by telegraph at each blow. The advantages of the American fire alarm telegraph are stated to be these:—1. It furnishes an indefinite number of signal stations, scattered broadcast over a city, from which an alarm may be communicated. No time is lost, therefore, between the fire itself and the telegraph. 2. The operator, or the watchman at the centre, receives the intelligence immediately, and forthwith strikes the district number on one or all the alarm bells by telegraphic agency. 3. The number of the *station* from which the alarm proceeded, as well as the *district*, is telegraphed to the fire department, so that the engines are headed from the first to almost the exact locality of the fire. 4. It is protected from interruption, either by accident or design, and it works with equal certainty and promptitude in all weathers, and both by day and night. 5. It prevents almost entirely the occurrence of false alarms, which entail a great expense on a city, on account of the wear and tear of engines. 6. It provides a system of organization, by which the whole fire department of a city is brought into communication with a single centre, receiving directions from this centre, either by the bells or signal boxes, and communicating back to it by a finger key, which, in addition to the crank, is placed in every signal box.

Logan's Portable Winch for Shipbuilders.—This winch is constructed so that it can be fixed in any position, and may be adjusted with facility to the work to be performed. To this end the winch is formed with a sole plate of malleable iron, and is fitted upon an under sole plate, upon which it turns by means of a swivel joint. The under sole plate is formed with clamps, or bent ends, by which it can be hung upon any fixture, as the frames, plates, or other part of a ship, or of a boiler, or other structure. The whole apparatus can be carried by one man, and can be moved along the plates, or other part on which it is hung, at pleasure. The two sole plates are formed with regularly pitched holes, arranged so that those in one plate may be brought fairly opposite to those in the other. Thus, on the winch being adjusted, it can be fixed in position by means of pins passed through the holes in the two plates. This apparatus will be of great utility in the construction of iron ships, boilers, and all other structures in which heavy weights have to be lifted and moved about. Thus the winch can always be conveniently placed, and the tackle can be fixed immediately over the plate, frame, or other article to be lifted, whilst it is immaterial in what position the winch is fixed, as the swivel joint arrangement gives it the power of accurately adjusting itself to the work it has to perform.

The Hydraulic Mortars and Cements of Turkey.—It is a common subject of remark, that many semibarbarous countries are in possession of contrivances and processes which we, and other more advanced nations, have hitherto failed to reach. There is some truth, and much error, in all this; and a really solid investigation into foreign scientific possession would most probably tend to disabuse us of the notion to a very great extent. Hints are, of course, to be gathered from many unpromising quarters; and, with this view of the matter, we venture to draw a contribution from the East, turning to the aqueducts of Constantinople for an example of Turkish art. The lime mortar prepared by our present allies in arms, is prepared from two parts of powdered lime, or *staub cauk,* as it is called in Eastern jargon, and one part of river sand. Their hydraulic mortar is made from finely powdered bricks, one part mixed with two parts of powdered lime. This mortar is applied in what appears to us an enormous thickness, the courses of the plastic material being fully as thick as the brick courses themselves; and it is a particular point that the bricks should be primarily soaked in water. Turkish hydraulic cement, for the internal dressing of arched aqueducts and similar works, is thus made:—To 100 ockas, of 2½ lbs. of our weight, of fluid lime, there are added 4 kilots (at 22 ockas) and 2 ockas of very minutely plucked tow, which is to be distributed very accurately throughout the mass. If these two ingredients have been duly mixed and worked up, the mass thus obtained remains quiet during eight days, that the tow may have time to combine thoroughly with the lime. If the mortar is to be used, it is again to be well stirred up, and is to be spread with a small trowel; and after this first operation has been performed, the dressing is yet to be rubbed gently, but repeatedly, with the trowel, until the surface is quite smooth and plain. For the sake of protecting it still more from the action of the water, and to make it durable for a long time, it is then to be coated by a putty, thus prepared:—To 100 ockas of freshly-burnt lime, converted into dust, 25 ockas of the best linseed oil are added, as well as 20 drachms (1 ocka = 2½ lbs. = 400 drachms) of rough cotton. The lime is to be worked and mixed in a wooden chest or trough while the linseed oil and the cotton are added in succession, until the mass has obtained the consistency of dough This mass is preserved, making of it large pieces, resembling loaves of bread. When used, it is stirred up with linseed oil until it becomes fluid, and fit to make a coating, which is painted over twice or thrice. In employing it for lead water-pipes, it is thus used. The lead pipes are made of a length of 0·65 m., and first cemented in their whole length, only at the other end. 0·16 m. is left free for being able to unite them. If two of these pipes are to be united, one of the ends of the pipe is cut perpendicularly into several pieces with a hand-saw, and they are bound around in the shape of a funnel. We then take some well-combed long-threaded hemp, soak it with the putty, and cover with it the end of the pipe, A, which is to be united to the pipe, B, in such a way that the hemp bundles lie close to each other; but, at the same time, these envelopings are to be so arranged, that only one-half of the length of these hemp skeins has been employed. The end of the pipe, A, thus prepared, is then placed in the funnel-shaped end of the pipe, B; and the cut asunder portion of the pipe end, B, is then to be compressed by the remaining portion of the hemp. This envelope, as it were, of hemp, is then tied over with a string, of about 3 lines diameter, in such a way that the threads lie close to each other. When cements become dry, they acquire the hardness of stone, resist all moisture, and possess an indestructible durability. If the pipes lie in an ascending position, two such cementations are to be made, for obtaining an adequate resistance; for those lying in the ground, one is sufficient. The pipes thus united are placed in small drains, supported at intervals, for avoiding bending, and surrounded by mortar, mixed with brick-dust. If the pipes treated in that way are of large diameter, the whole is to be well dried before the water is let in, a precaution unnecessary with small pipes.

London Coal.—The quantity of coal imported into the port of London during the past year, specifying the names of the places the cargoes were sent from, the number of ships from each place, whether sea, road, canal, or rail borne, the quantities in tons, and the numbers in comparison in the preceding year, as given below, conveys somewhat vividly the facts of the vast fuel consumption of the chief city of the world. Newcastle—ships, 3,188; tons, 1,090,668. Newcastle Wallsend—ships, 1,076; tons, 304,961. Sunderland—ships, 130; tons, 36,153. Sunderland Wallsend—ships, 2,074; tons, 640,795. Seaham—ships, 1,237; tons, 303,540. Hartlepool and Hartlepool west—ships, 2,610; tons, 736,131. Stockton and Middlesborough—ships, 352; tons, 79,446. Blyth—ships, 242; tons, 49,118. Scotch—ships, 145; tons, 25,644. Welsh—ships, 313; tons, 86,144. Yorkshire—ships, 409; tons, 31,299. Liverpool—one ship; tons, 560. Philadelphia (United States)—one ship; tons, 69. Small coal—46 ships; tons, 11,263. The total number of ships employed in 1854 in the sea-borne importations was 11,824; tons weight of coal imported into the port of London, 3,395,791; in the year 1853 the number of ships was upwards of 12,000, but the quantity brought was about the same. The quantity of coals brought by railway, canal, and common roads in 1854 was 979,170 tons and 14 cwt.—making the total of the London district of all classes 4,374,961 tons 14 cwt.

Gwynne's Centrifugal Pump for Raising Sunk Ships.—The following letter from the owners of a ship sunk in the Missouri is good practical testimony to the value of this pump for the heavy work of raising vessels:—"The *Ironton* struck a large submerged rock on the Missouri river, eighty-five miles above St. Louis, last month, and filled in about forty minutes, and sunk in about ten feet water. She was somewhat listed, and one guard and part of her deck was just out of water, while the other guard had some three or four feet of water over it. We sent one of our steam diving-bell boats, (the '*Submarine*, No. 6,') to the wreck, where she arrived on Sunday, at dark. The next morning, while part of her crew were adjusting the suction hose (twenty-one inches in diameter), our carpenters curbed off the hatches, and by 10 o'clock, A.M., steam being up, we started the pump, and *in less than ten minutes* the water was so low that the suction-pipe took air, the water being only seven or eight inches deep on her floor timbers. The pump kept the water down until the carpenters succeeded in bulkheading or partitioning off the break in her hull, and before dark the *Ironton* was safely floating. Steam was raised on her, and she was brought down to this city, where she has been docked. The pumping engine used on this occasion was one of your pattern, called B. No. 3; and some idea of its power may be inferred from the fact, that we did not stop the break at all in her hull before we pumped the water out of her. The dock showed the damage to be, crushing in her larboard knuckle for twenty feet. The planks were completely shattered for this distance, and about thirty inches in width; and every timber, futtock, and her knuckle kelson, in this space, were broken in. The tonnage of the *Ironton* is about one hundred and fifty tons. We estimated the discharge of the pump at about five hundred barrels per minute. The stream from it was ten inches deep, thirty-four inches wide, and ran at the rate of ten miles per hour, as we ascertained by a light paddle wheel made for the purpose.—Eads & Nelson."

Messrs. Bradbury and Evans' Medallion Engraving Machines.—We have before us specimens of the most beautifully executed medallion engraving ever produced, at least in this country. They are the work of Messrs. Bradbury and Evans, who, in announcing their performance, state that they "have lately come into the possession of two of the most remarkable Line Medallion Engraving Machines that have as yet been constructed, which possess the important advantages of reversing the position, as well as of increasing or reducing the size of the original." The subject submitted to us by Messrs. Bradbury and Evans, in the present instance, is the Exhibition Prize Medal of 1851, on the size of the original. The relief is most admirably rendered from both the obverse and reverse, and the precision of the lining is much superior to anything we have hitherto seen

Permanent Impressions of Flowers on Glass.—Mr. Robert Smith, of Blackford, who has often contributed to our pages, has contrived a very ingenious and effective plan of ornamenting glass, by producing thereon, permanent impressions of flowers, leaves of plants, and other objects. In this process of ornamentation, the operator goes to work by first preparing the objects to be reproduced on the glass surface with a solution of gum. The details of the figure are thus attached to the glass, in the positions required by the device. The entire face of the glass thus treated, is then covered over with a composition of oil, tallow, and wax, in a warm state. When this composition coat becomes solid, the objects are removed from the glass, which is now submitted to the action of fluorine gas; or liquid fluorine may be poured upon the glass; or further, the plate may be treated with fluor spar and sulphuric acid. This is the ordinary treatment involved in glass-etching—the peculiarity of Mr. Smith's process being the mode in which the design or the line of action of the acid is produced. The fluorine corrodes the glass only at the parts where the flowers or pattern objects have been placed, and hence the forms of the objects, however elaborate or delicate, are faithfully reproduced from the models supplied by nature herself. The ornamental designs produced in this way are extremely beautiful, contrasting as strongly with the result of ordinary staining, as does a good daguerreotype picture, or nature painting, with a mechanically produced engraving; the figuring accomplished in this way may be coloured as fancy suggests, by the common process of baking or "burning-in" in a furnace. This is another of those processes, by which we are now compelling nature to reproduce for us her choicest devices in a more enduring form.

Locomotive Expenses and Statistics.—The total cost of locomotive power, including repairs, on the Caledonian Railway, is 8d. per train mile, and including the working repairs of waggon and carriage stock, 10·08d. per train mile. The average number of engines in steam during the past half-year has been 90, and the number of train miles run, 8,532 per day. The average number of engines in working order has been 118, repairing 20, and renewing 7, together 145. The passenger trains averaged 7·19 carriages, and the goods trains 22·65 waggons.

Modern Rail Bar Rolling.—The Rhymney Iron Works Company has just rolled the largest railway bar ever produced. It is one of Barlow's patent rails, and has been sent to the Paris Exhibition. Previous to the appearance of this example of such rolling, a 22-feet rail was the ultimatum, but the Rhymney Company has gone, at one stride, to a length of 52 feet 6 inches. Mr. G. P. Hubbuck, the managing engineer of the works, conducted the operation, and he has made such excellent work in the present instance, that the rail has not been painted. It is simply brushed over with oil to repel the attacks of rust, and in this condition it will make its appearance in the great show of France.

The Society of Arts.—The following circular note has been issued by the Council of the Society of Arts:—"Although the number of members keeps steadily increasing, yet this increase is not proportionate to the expense at present incurred in carrying out the objects of the Society, in the manner which recent experience has proved to be desirable. The 'Journal of the Society of Arts,' for instance, necessarily involves a large expenditure, but it is believed that the rapid publication, *in extenso*, of the proceedings of the weekly evening meetings, has fully justified the outlay, whilst it has undoubtedly improved the character of the papers read, and of the discussions upon them. If, therefore, every member of the Society would but introduce *one* friend as a member, it would confirm the Council in the prudence of their present policy, as well as enable them more fully to develop it. P. Le Neve Foster, Secretary." The Society certainly deserves well of the public, and we, therefore, recommend this hint to the consideration of our readers.

Paris Exhibition in 1855.—M. Pains, the editor of the Official Catalogues of the Imperial Commission, has issued a prospectus of an Illustrated Catalogue of the exhibited articles, by way of following up the idea acted upon in this country in 1851. The mode of publication of tho work, however, differs considerably from our plain way of buying and selling. Each exhibitor who purchases a notice space in the work for his contributions, is to be entitled to a copy of the volume. For a space of twenty lines he is to pay 100 francs, and so on, according to his wants, up to 1000 francs, which payment entitles him to a page of print and a page pictorial illustrations. The Parisians, no doubt, look forward to many benefits, too, for their city's trade during the gathering. M. Pains' prospectus furnishes an example of this feeling, in a large illustration of "*Diner de l'Exposition, Rue Lafitte et Rue Lepelletier, en face l'Opero*," showing us on what a grand scale our light-hearted neighbours prepare for public eating and drinking operations. Sunderland has just held a little exhibition of its own, of the articles which it is about to contribute to the Paris show. This local exhibition was quite an interesting thing in its way; and it has discovered to us what this little busy northern town intends to do as its share of the French undertaking. At the suggestion of Mr. Hartley, the glass manufacturer, a case of sixteen glass cylinders was prepared, for holding a series of models of Sunderland's staple production, ship-building. In wood carvings, there are three exhibitors; and the surrounding collieries have joined in sending sixty-five different specimens of coal. Mr. Wailes, of Hetton Colliery, has a large model of a coal pit, showing the whole management of the seam. Mr. Boneve contributes seven Davy lamps, and an example of the old steel mill formerly used as the source of colliery lights. Glass is well represented by examples from the large works of Messrs. Hartley and Messrs. Attwood. A large sum has been received at the exhibition doors; so that the promoters may really be said to have made the most of their scheme. M. Pains informs us that there are 25,000 exhibitors on the books, from thirty-six different nations.

Robinson's Screw and Slide Lever Steering Gear.—A simple, powerful, and apparently durable steering apparatus for ships, has lately been patented by Mr. John Robinson of North Shields, and worked out by the well-known makers, Messrs. Pow & Fawens of that place. In this arrangement, the steering wheel is set a little out of the keel line of the ship, on the port side; and its spindle, which is carried in two end pedestal bearings, is cut with a stout square screw thread. This screw spindle has upon it a long traversing nut, fitted with a pair of diametrically opposed joint stud pins, for connection with the end of the sliding lever, which forms the actual tiller. The joint end of this lever is made with a fork, and straps for embracing the stud pins of the nut. The remaining portion of the lever is a plain cylinder, and it is entered freely through a long inclined eye-piece on the rudder head, which is, of course, on the starboard side of the screw spindle, and opposite to the longitudinal centre of the latter. The eye on the rudder head works on a stud pin, so that, in all circumstances, the action is easy and free from strain. As the screw spindle nut traverses forward or aft, in obedience to the turn of the steering wheel, it carries with it the outer end of the tiller, which thus acts as a lever to turn the rudder; and as the nut must always move in a straight line, the sliding tiller traverses back and forward in the eye of the rudder head, to reconcile the right line action of the nut with the rotatory action of the rudder head. The effective leverage of the tiller thus becomes greater as the rudder is moved from amidships to either the starboard or port side, and hence the steersman's power is increased in proportion to the external fluid resisted.

Boxing off Mill Shafting.—The obnoxious regulation, noticed by us just a year ago, continues to cause a ferment amongst mill-owners of all kinds, and the great opposition feeling has resulted in several influential meetings for the combined discussion of the subject. At the time of the first issue of the boxing off instructions, a deputation, of not fewer than eighty gentlemen from all quarters, waited on Lord Palmerston, and obtained the suspension of the order. Recently, however, the boxing off has been insisted on; and several convictions have occurred in consequence of resistance to it. Now, the mill-owners, who, in such cases as this, know their own business best, have all along seen that the regulation could not possibly be carried out without excessive expense, a serious interference with the routine of manufacturing operations, an increase in the terms of their insurance, and, worse than all, a positive multiplication of the dangers of accident to the work-people. When we state that it involves the total covering in of all horizontal shafts not more than seven feet high, we perhaps say enough to show that the framers of the new rules have totally misconceived the working of factory machinery. As to the general details into which legal restrictions of this order enter, Mr. Henry Houldsworth, of Manchester, when at the great Manchester meeting the other day, spoke very much to the point, when he told the assembled mill-owners, that in a single room in his mill he had no fewer than 315 "points of danger," as defined by the bill proposed in 1841. When Mr. Horner had this explained to him, the bill was withdrawn. Now this room has been filled with workpeople and machinery for twenty-five years, and although the points of danger have remained the same, no serious accident has occurred in it, except one, which would have arisen even had the whole of the 315 points been securely fenced. The present act, as now interpreted, brings with it all the vexatious requirements of 1841, and the factory employers are therefore fully justified, as it seems to us, in combining to resist its interference, for several manufacturers have personally assured us, that they would close their mills rather than carry out the present views of the government inspectors.

Steam as an Industrial Agent.—Mr. William Fairbairn, whose great services in developing mechanical science can never be overlooked or forgotten in any quarter of the world where mechanical talent possesses rank at all, has just given one more proof of his attention to the exigencies of the times, by delivering two elaborate lectures at the Manchester Mechanics' Institution, on "Steam, its properties and application to the useful and industrial arts." In that great centre of steam power, such a subject, commented upon by such an authority, and coming, too, in the wake of the movement there making to secure a better system of steam superintendence, was certain of meeting with more than ordinary attention; and we are glad to find that the lecturer's efforts were duly appreciated by the large audiences assembled to meet him. In that portion of his discourse which related to boilers, he stated that the cylindrical or spherical was the most eligible and the strongest form in which iron plates would resist internal pressure. The deduction for loss of strength, on account of riveted joints and the position of the plates, was about 30 per cent. for the double riveted joints, and 44 per cent. for the single ones; the strengths (calling the plates 100) being in the ratio of 100, 70, and 56. He found that 34,000 lb. to the square inch was the ultimate strength of boilers having their joints crossed and soundly riveted. Flat surfaces, frequently essential, were not so objectionable with respect to strength as they appeared to be at first sight, but, when properly stayed, were the strongest part of the construction. This was proved by the result of experiments made on the occasion of the bursting of a boiler at Longsight. Two thin boxes, 22 inches square and 3 inches deep, were constructed. One corresponded in every respect to the sides of the fire-box of the exploded boiler, the stays being in squares, 5 inches asunder, and the side containing 16 squares of 25 inches area. The other contained 25 squares of 16 inches area, the stays being 4 inches asunder. One side of both boxes was a copper plate $\frac{1}{2}$ inch thick; and the other side of both an iron plate three-eighths inch thick. To these the same valve, lever, and weight were attached, and the pumps of an hydraulic press applied. That divided into squares of 25 inches area, swelled ·03 inch with the eighth experiment, at a pressure of 455 lb. to the square inch. At the nineteenth experiment, with a pressure of 785 lb. to the square inch, the sides swelled ·08 inch; and at a pressure of 815 lb., the box burst by the drawing of the head of one of the stays through the copper, which, from its ductility, offered less resistance to pressure in that part where the stay was inserted. The tenth experiment, with the other box of 16 inch areas, resulted in a swelling of ·04 inch, the pressure being 515 lb. to the square inch. At 965 lb., the swelling was ·08 inch, and from that point up to 1,265 lb. the bulging was inappreciable. With the forty-seventh experiment, at a pressure of 1,625 lb., one of the stays was drawn through the iron plate, after sustaining the pressure upwards of $1\frac{1}{2}$ minutes, the swelling at 1,595 lb. having been ·34 inch. The first series of experiments proved the superior strength of the flat surfaces of a locomotive fire-box, as compared with the top or even the cylindrical part of the boiler. The latter evidenced an enormous resisting power, much greater than could be attained in any other part of the boiler, however good the construction; and they showed that the weakest part of the box was not in the copper but in the iron plates, which gave way by stripping or tearing asunder the threads or screws in part of the iron plate. According to the mathematical theory, the strength of the second plate would have been 1,273 lb.; but it sustained 1,625 lb., showing an excess of one-fourth above that indicated by the law, and that strength decreased in a higher ratio than the increase of space between the stays. The experiments show a close analogy as respects the strengths of the stays when screwed into the plates, whether of copper or iron; and riveting added nearly 14 per cent. to the strength which the simple screw afforded. These experiments were conducted at a temperature not exceeding 50° Fahrenheit. His experiments on the effects of temperature on cast-iron, did not indicate much loss of strength up to a temperature of 600°; and he concluded that the resisting stays and plates of locomotive boilers were not seriously affected by the increased temperature to which they were subjected in a regular course of working. At the termination of the second lecture, Messrs. E. T. Bellhouse, Fenton, and Kay, severally explained a set of models and drawings of safety valves. Mr. Bellhouse directed the attention of the audience to Cowburn's "oscillating safety valve," as illustrated by us last month; he also explained some diagrams of vacuum and float valves, the joint invention of himself and Mr. Cowburn. Mr. Fenton's valve was shown to be composed of two globular valves under the same lever; at one end of the lever is an adjustable spiral spring, which, when set, can be covered up and locked, so as not to be interfered with; the other end of the lever has an ordinary spring balance. The peculiarity of this valve is, that if a greater weight be put on the exposed end of the lever, the one ball valve becomes the fulcrum, and causes the other valve to be raised, and allows of the exit of steam at a lower pressure than the spiral spring is set to. Mr. Kay's valve is on the piston principle, so arranged as to afford a large area for the emission of steam.

MACHINE-MADE WATCHES IN AMERICA.—During the war of 1812, a few watches of the bulls-eye pattern were made in Concord, in the United States, but they were, of course, inferior to the imported ones, and though individuals have since then attempted on a small scale to do something in this way, no permanent establishment has ever been founded in that country until now. Some five years since, Messrs. Howard & Davis, in connection with Mr. A. L. Dennison, commenced a branch of this business in Roxbury, and though the most serious obstacles were in the way, they have persevered, slowly gaining knowledge by experience, and slowly attaining the object of their desires. The want of machinery, and the inexperience of labourers, have been great drawbacks, but they have gradually overcome these, and have now every convenience for the successful prosecution of their business. Their establishment in Roxbury was so surrounded by dusty localities, that it was found impossible to obtain perfection in works which were liable to this inconvenience, and a location for a building was therefore selected in Waltham, which is most admirably adapted to the purpose. The building, occupying a third of an acre, is a curiosity in itself, for it is the first structure erected in this vicinity of the "gravel wall," or "concrete material," which has been brought to public notice by Mr. O. S. Fowler. The concrete consists simply of limestones and sand, mixed as we do mortar, and then, by a simple process, piled up in layers, which becomes hard, and in the lapse of years is as solid as stone. The building, thus constructed at an expense of one-third of what it would cost to erect a brick edifice, and which is comparatively fireproof, has stood the cold of the present severe winter, and established, beyond a doubt, its adaptability to ordinary uses. The manufactory at Waltham is a two-story building, built in the form of a square. Mr. Dennison, assisted by Mr. Stratton, superintends the works, and a twelve-horse engine furnishes the motive power for the machinery, heats the entire building, and carries from the river, water into the reservoir which supplies every part of the building with water. The different departments are separated, and each gang of mechanics has a distinct portion of the watch to manufacture. In one room the plate is cut, in another the jewels are reduced to a proper size, while the second hands, minute hands, the jewel screws, the wheels, the springs, the cases, the engraving and the polishing require each a distinct process, in which different classes of operatives are engaged. The operatives number at present about fifty, a quarter of whom are females, who are found well adapted to the business, and it is a fact worthy of note, that these American watches are the product of American operatives. In Locle and other Swiss towns, where watches are made, the parts are manufactured in the cottages of the workmen, and are then carried to head-quarters, and put together; little machinery is used; here under one roof the watch is completed, by the aid of machinery, and less skilful hands. In a few months, when under full blast, at the strike of each hour, it is expected that a watch will be finished, that is, twelve per day. The cost, of course, depends upon the style of the cases; those in gold will range, at retail, from 75 to 100 dols., and those in silver, from 30 to 40 dols. The Company intend manufacturing large quantities of watches of the hunting style. Parts of watches, screws, hands, wheels, are also neatly put up on cards, and are much sought after by the trade. The new manufacture, prosecuted thus energetically, must be a source of great pride and profit to our American neighbours.

FLAX AND PLANTAIN FIBRE FOR PAPER-MAKING.—A bill for the incorporation of an undertaking, to be called the Fibre Company, for supplying the serious want of a cheap material for paper by means of the fibre of common flax, is now before Parliament, after vain endeavours to avoid the trouble and expense of going there by obtaining a charter of limited liability. The West India plantain, too, has been called to the paper-maker's aid. This was noticed, a few nights back, in the House of Lords, by the Earl of Derby, who produced some specimens of the raw and manufactured articles. These were—a specimen of the fibre of the plantain (*Musa Paradisiaca*), and a specimen of a textile fabric, of silky appearance, manufactured from the fibre; a specimen of the fibre of the *Hibiscus Esculentus* (Okhro); a specimen from the seed-pod of the *Cryptostegia Grandiflora*, suitable for india-rubber withe. The body of the plant yields gum caoutchouc, and the bark of the branches, a fine fibre. Also, two specimens of paper made from the plantain fibre; one specimen rough and unbleached, to show the great strength and tenacity of the fibre, and another specimen, of very good quality, bleached and carried through all the operations for the best paper. Paper made from the plantain fibre, and of an excellent quality, can be supplied at a cheaper rate than that made from rags. The abundance of the material is naturally an important element in the question. On one estate in Demerara, there are cut down 160,000 plantain trees every year, merely for the purpose of clearing. All these trees contain fibre capable of being manufactured into textile fabrics, or rope of various degrees of tenacity, or paper. The inventors have obtained a patent, and have made application to the Legislatures of Jamaica and British Guiana, and in both these colonies this invention has been made the subject of specific notice in the Governor's speech. The process and the machinery employed have been examined by committees of both Houses of Parliament in these colonies, and their reports have been most favourable to the undertaking, so that the measures necessary to carry out the project have been passed at the public expense. If the Government could do anything to promote a manufacture which finds an inexhaustible quantity of raw material, to meet a demand that is unlimited—for hemp, for textile fabrics of various kinds, and, last of all, for paper cheaper than could be formed of rags—and if these articles could be produced in colonies that have suffered such great distress, they would do much to introduce new prosperity into these colonies from a new description of industry. The matter is one of no ordinary importance, and it was well deserving the attention of the Government.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded October 24, 1854.

2264. Isaac Adams, Massachusetts, U.S.—New and useful improvements in machinery for printing.

Recorded December 23.

2719. Warren De la Rue, Bunhill-row—Improvements in treating products arising from the distillation of a certain tar or naphtha, to render the same suitable for dissolving or removing fatty or resinous substances.

Recorded December 30.

2758. Francis Preston, Manchester—Improvements in bayonets, and in the machinery for manufacturing the same.

Recorded January 10, 1855.

67. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the construction and manufacture of ordnance.

Recorded January 13.

92. John Britten, Birmingham—An improvement or improvements in the means of filtering liquids.

Recorded January 16.

116. Jean A. F. V. Oudin, Mons, France, and 4 South-street, Finsbury—Invention of a new liquid for preventing sea-sickness.

Recorded January 20.

161. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the construction of seats and similar articles of furniture.—(Communication from Pierre Sholtus, Paris.)

Recorded January 22.

162. Saunders Trotman, Portman-square—Improvements in filtering apparatus.

Recorded January 24.

182. John Livesey, New Lenton, Nottingham—Improvements in lace machinery.

Recorded January 26.

197. William Binns, Claremont-villa, Victoria-grove, Brompton, and James Haughton, Bankside New-mill, Oldham—Certain improvements in valves for stopping, retarding, and regulating the flow of steam, water, or other fluids.
206. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the construction of kites, and in the application thereof to the purposes of carrying lines and of signalling.—(Communication from André M. Préverand, Paris.)

Recorded January 27.

207. John Hutchinson, Huddersfield—Improvements in apparatus to economize steam.
210. Elias Davis, Aldgate—Improvements in rendering paper waterproof.

Recorded January 29.

215. William Polkinhorn, Gwenap, near Redruth, Cornwall—Improvements in apparatus for cleansing wheat.
217. John D. Humphreys, 20 Charlotte-street, Caledonian-road—Improvements in steam engines.
219. George Goodfellow, Great Fenton, Stoke-upon-Trent, Staffordshire Potteries—Improvements in supplying heated air to the bottoms and flues of potters' and brickmakers' ovens and kilns, and of steam-engine boilers.
221. Thomas Binks, Wentworth, Yorkshire—Improvements in raising and regulating the supply of water and other fluids.
223. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the generation of steam.—(Communication from Paulin J. C. Montety, Toulon.)
224. Alphonse Pichot, Poitiers, France, and 32 Essex-street, Strand—Certain improvements in postage paper and envelopes.
225. Ephraim Death and John Popplewell, both of Halstead, Essex—An improved stop valve or cock for water, gas, and other liquids and fluids.
226. Edward Cunnah and John Hampson, Liverpool—Improved turnstile counting apparatus.

Recorded January 30.

227. David Moline, Adelaide-place—Improvements in the manufacture of metallic window-frames and skylights.—(Communication.)
228. Richard A. Brooman, 166 Fleet-street—An improved filter.—(Communication.)
230. George W. Henri, Fishergate, York—Invention of a new compound or meal mixture for feeding cattle.
231. Henry D. Pochin, Salford—Improvements in the treatment of certain compounds of alumina, and the application of the same in printing, dyeing, tawing, paper-making, and such like purposes.
232. David Warren, Glasgow—Improvements in screw propellers.

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Recorded January 31.

233. John Smith, Langley Mills, Brancepeth, Durham, and James Hollingworth, same place—Improvements in treating certain fibrous materials for manufacturing paper.
234. Arthur Lyon, Windmill-street, Finsbury—An improvement in sausage-making or mincing machines.
235. Stephen White, Southport—Improvements in the manufacture of pencils or crayons.
236. George Price, Wolverhampton—Improvements in iron safes, chests, and boxes.
237. James Howard, Bedford—Improvements in ploughs.
238. Jacques Roux Delguey-Malavas, Montbrison, France—Improved machinery for obtaining and applying motive power.
239. Martin Samuelson and Alexander Samnelson, Scott-street Foundry, Hull—Improvements in steam engines.
240. John F. Porter, Bessborough-street—Improvements in the manufacture of bricks and other articles of clay or brick earth.
241. Josiah Harrington, 14 Pelham-street, Brompton—Improvements in priming fire-arms.
242. Auguste E. L. Bellford, 32 Essex-street—Improvements in machinery for forging nuts and washers.—(Communication.)

Recorded February 1.

243. William Taylor, 16 Oxford-terrace, Hyde-park—Improvements in cables for holding at anchor and towing ships and other floating bodies.
244. Thomas O. Dixon, Steeton, near Keighley, Yorkshire—Improvements in machinery or apparatus for turning, boring, cutting, and shaping wood and similar materials.
245. Alexander Prince, 4 Trafalgar-square, Charing-cross—Improvements in fire-arms.—(Communication.)
246. Isaac Jecks, Trowse Newton-lodge, near Norwich—Invention of a machine for sweeping grass or weeds from lawns or fields, and depositing the same into a box or other receptacle.
247. Alexander W. Williamson, University College, Gower-street—Improvements in apparatus for feeding fires.

Recorded February 2.

248. Benjamin Goodfellow, Hyde, Chester—Improvements in ordnance.
250. George Ritchie, 3 Monmouth-place, New-cross, New Kent-road—Improvements in beds or mattresses.
251. Jules Castel and Frederick M. Beaupré, Marseilles, and 32 Essex-street, Strand—Invention of a new system of burner for lamps, called the "pyropneumatie burner."
252. Isidore Carlhian and Isidore Corbière, Castle-street, 27 Holborn, and Paris—Certain improvements in moderator lamps.

Recorded February 3.

253. Frederick S. Thomas, 17 Cornhill, and William E. Tilley, 6 Kirby-street, St Andrews, Holborn—Improvements in plating or coating metals.
254. Patrick M. Crane, Athy, Kildare—Improvements in the manufacture of products from peat.
255. James T. Chance, Birmingham—Improvements in the manufacture of pipes or tubes of glass or other vitreous matter.
256. Robert J. Mary'on, 37 York-road, Lambeth—Improvement or improvements in the construction of and manufacture of bullets, or shot, or projectiles.
257. John Patterson, Beverley, Yorkshire—Improvements in machinery or apparatus for washing, wringing, and mangling or pressing clothes or textile fabrics.
258. Edmund Clegg, Shore-mill, near Littleborough, Lancashire, and James Leach, same place—Improvements in temples for looms.
259. Isaie Lippmann, Paris—An improved method of dyeing or colouring the hides and skins of animals.
260. Hippolyte V. Pinondel de la Bertoche, Paris—Certain improvements in manufacturing paper, pasteboard, and pulp.
261. Thomas Allan, Adelphi-terrace—Improvements in obtaining and transmitting motive power.
262. Edward C. Bisshopp, Stonehouse, Devonshire—Improvements in breech-loading fire-arms.

Recorded February 5.

263. Godfrey Pattison, Glasgow—Improvements in machinery for dressing and finishing woven goods or fabrics.—(Communication.)
264. Auguste E. L. Bellford, 32 Essex-street, Strand—An improved invention for constructing hulls of vessels.—(Communication.)
265. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture or construction of steam-boilers or generators, and in the application of materials to such manufacture.—(Communication from Jackson Brothers, Petin, Gaudet, & Co., Rive de Gier, France.)
266. Alexander Morton, Kilmarnock—Improvements in weaving carpets.
267. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and Paris—An improved mode of preserving railway and other tickets.—(Communication.)
268. John Dorrell, Bilston, Staffordshire—Improvements in machinery for pressing, squeezing, and rolling iron.
269. Ebenezer Hartnall, 1 St. Mary Axe—Improvements in preserving animal and vegetable substances for food.
270. John Imray, 64 Bridge-road, Lambeth—Improvements in measuring instruments.
271. Joseph Gibbons, 345 Oxford-street—An improvement in fixing the spindles of door locks to their knobs.
272. Pierre J. Carré, Asnières, Seine, France—Improvements in ornamenting fabrics with metal leaf.
273. Thomas B. Daft, Isle of Man—Improvements in the manufacture of beds or surfaces to recline or lie on.

Recorded February 6.

274. Deane J. Hoare, 10 Salisbury-street, Strand—Certain improvements in propelling vessels.
275. John Gedge, 4 Wellington-street South, Strand—Improvements in frames suitable for photographic or stereoscopic proofs or portraits.—(Communication from J. E. Pointeau, Paris.)
276. Henry Trappes, Manchester—Invention of a process for the preparation of leather, to be used in the manufacture of a new flock, and for the manufacture of the same, to be used and applied in lieu of flock made from pounded or ground wool and woollen materials heretofore commonly used in the manufacture of painted, printed, and dyed decorating papers, carpets, oil-cloths, and other things, and also to be used as a paste or pulp for the manufacture of all kinds of paper, parchment, and pasteboard, of toys, of ornamental and other picture frames, of mouldings, architectural and sculptural ornaments, and other things.—(Communication.)
277. Theo. Aston, Compton-street, Regent's-square—Improved apparatus and means for enabling persons conveyed in carriages to communicate with the drivers or conductors thereof.
278. Frederick Gray, Birmingham—An improvement or improvements in candlesticks.
279. Arthur Warner, 11 New Broad-street—Improvements in coating or combining sheet-iron and steel with sheet-lead, zinc, tin, copper, or alloys of such metals.
280. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the combination of materials for waterproofing and similar purposes.—(Communication from Jonathan T. Trotter, New York.)
281. Peter Smith, Glasgow—Improvements in machinery or apparatus for printing textile fabrics and other surfaces.
282. William S. Roberts, Lodersville, Susquehanna, Pennsylvania, U.S.—Invention of coupling railway carriages.
283. George Audemars, Lausanne, Switzerland—Improvements in obtaining and treating vegetable fibres.
284. John Grainger, Birchwood, Alfreton, Derbyshire—Improvements in the manufacture of pantiles.

Recorded February 7.

285. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and Paris—An improvement in the mode of applying, as motive power, heated air, combined with the vapour of ether, or of any other liquid easily vaporised.—(Communication.)
286. William Warbrick, Dukinfield, and John Walker, Compstall-bridge, near Stockport, Cheshire—Certain improvements in machines for preparing, spinning, doubling, warping, and dressing cotton, wool, and other fibrous substances.
287. John G. Johnson, 18A Basinghall-street—Improvements in surgical bandages.
288. George T. Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in steam-ploughing machines.—(Communication from Obed Hussey.)
289. Edward Davies, Liverpool—An improvement in the manufacture of an oil and paraffin from a material not hitherto used for such purposes.
290. George T. Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in looms for weaving ornamental figured fabrics, and in the construction of the rollers to be used upon the pattern chains of such looms.—(Communication.)
291. Richard D. Chatterton, Cobourg, Canada West—Improvements in propelling vessels.
292. Augustus J. Hoffstaedt, Albion-place, Blackfriars, and Samuel Blackwell, 259 Oxford-street—An improvement in powder-flasks and shot belts or pouches.
293. George Briggs, Wigmore-street—An improved spring for carriages.
294. Alfred V. Newton, 66 Chancery-lane—An improved construction of spur.—(Communication.)
295. Alfred V. Newton, 66 Chancery-lane—An improved mode of constructing dry docks. (Communication.)
296. William Hartfield, Prospect-row, Bermondsey—Invention for making book-covers in tortoise-shell, inlaid or not with pearl or ivory, and for improvements in machinery for embossing, carving, and inlaying book-covers with pearl and ivory, and for making metal joints, by which such books may be widely opened; the said improvements to be applicable to inlaying pianofortes.

Recorded February 8.

297. John Wilson, Manchester—Improvements in the manufacture of rollers for printing and embossing calico and other fabrics.
298. Adolphe Girard, Pertuis, Vaucluse, France, and 32 Essex-street, Strand—Certain improvements in extinguishing fires.
299. Francis Puls, Soho-square—Certain improvements in apparatus to be used in smoking tobacco.
300. Joseph Armstrong, Normanton Station, Wakefield, Yorkshire—Improvements in certain parts of the permanent way of railways.
301. George F. Wilson and George Payne, Belmont, Vauxhall—Improvements in treating glycerine.
302. Frederick Ransome, Ipswich—Improvements in drying articles made of plastic materials.
303. Robert J. Mary'on, 37 York-road, Lambeth—Improvement or improvements in the construction and manufacture of ordnance; part or section of his said invention be applies for improvement in the construction of fire-arms of every class.

Recorded February 9.

304. Charles Armsdell, Fenchurch-street—An improved sifter or shovel.
305. Joseph Martin, Liverpool—Improvements in machinery for treating wheat and other grain.
306. William B. Adams, 1 Adam-street, Adelphi—Improvements in the construction and application of elastic springs for sustaining loads or moderating concussion in fixed or moving machines or carriages.
307. John Lees and William Heap, Ashton-under-Lyne—A new or improved machine or apparatus for cutting and straightening bars of metal.
308. William B. Johnson, Manchester—Improvements in steam-boilers and engines.
309. Barthélemy Pont, Paris—Invention of a process of autographic engraving.
310. Francis Parker, Northampton—An improvement in the manufacture of paper.
311. John Langman, Plymouth—Improvements in portable buildings specially adapted to campaigning purposes.

Recorded February 10.

312. Charles Barnard and John Bishop, Norwich—Improvements in apparatus for cutting vegetable substances.
313. Edward Sparkhall, 142 Cheapside—Improvements in the exhibition of pictorial representations of various subjects.
314. George H. Ingall, Throgmorton-street—Certain improvements in telegraph communication, and apparatus connected therewith.
315. Samuel Russell, Sheffield—Improvements in projectiles for fire-arms and ordnance.
316. George H. Cottam and Henry R. Cottam, St. Pancras Iron Works, Old St. Pancras-road—Improvements in the construction of iron buildings.
317. William Balk, Ipswich—Improvements in machinery for crushing grain and other substances.
318. Alexander Sands, Liverpool—An improved fastening or detainer, to be employed as a substitute for "clothes-pegs," or for other similar purposes.—(Communication.)
319. Louis A. F. Besnard, Paris, and 4 South-street, Finsbury—An improved composition for fixing lithographs and engravings on canvas, after being transposed or reproduced by a printing-press.
320. Auguste E. L. Bellford, 32 Essex-street, Strand—Invention of certain materials to be used for cementing and painting, and also applicable to printing and dressing or finishing fabrics.—(Communication from Professor Frederic Kuhlmann, Lille, France.)
321. George Rennie, Holland-street—Improvements in marine steam-engines.

Recorded February 12.

322. John Ramsbottom, Longsight, near Manchester—Improvements in the construction of certain metallic pistons.
323. Samuel Smith, Manchester—Improvements in machinery for winding cotton and other yarns or threads.
324. George Lucas, Hulme, Manchester—Certain improvements in machinery for preparing, spinning, doubling, and twisting cotton, wool, silk, and other fibrous materials.
325. David Barr, Birmingham—A new or improved tap for hot and cold fluids, steam, and gases.
326. Robert Kerr, 41 Coleman-street—Certain improvements in preparing loaf sugar for use, and certain apparatus for the same.

327. Richard S. Harris, Leicester—Improvements in the manufacture of looped fabrics.
328. John Foster, Long Eaton, Derby—Improvements in machinery for the manufacture of lace.

Recorded February 13.

329. Samuel Smith, Manchester, and Moses Morris, Swinton, near Manchester—An improved machine for spinning cotton and other fibrous materials.
330. Joseph L. Lambot, Carces, Var, France, and 32 Essex-street, Strand—An improved building material to be used as a substitute for wood.
331. Auguste Vallery, Rouen, France, and 32 Essex-street, Strand—Improved machinery for the preparation of flax, hemp, and other textile materials.
332. Robert P. Comfield, Upper Holloway—Improvements in the electro-coating of iron and other metals with zinc and other metals.—(Partly a communication.)
333. George Dalton, Lymington—Improvements in reverberatory furnaces.

Recorded February 14.

334. Thomas Metcalfe, William Slaiding, and John Metcalfe, Clitheroe, Lancashire—An improvement in the machines for preparing cotton, known as Dyer's tube-frames.
335. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in governors or regulators for steam engines or other prime movers.—(Communication.)
336. John R. Isaac, Liverpool—Improvements in the construction of portable buildings.
337. James Nichol, Edinburgh—Improvements in bookbinding.
338. Hugh L. Pattinson, jun., Stotes Hall, Jesmond, Newcastle-upon-Tyne—An improvement in the manufacture of iron carriage-wheels.
339. Francis B. Blanchard, Maine, U.S.—Invention of a new and useful apparatus for generating motive power from heated air, steam, and the products of the combustion of coal or other fuel.

Recorded February 15.

340. William Blythe, Oswaldtwistle, and Emile Kope, Accrington, Lancashire—Improvements in the manufacture of soda ash and sulphuric acid.
341. Robert Molesworth, Halfmoon-street, Bishopsgate-street, City—Improvements in the construction of brushes.
342. James Leadbetter, Halifax—Improvements in the mode or method of applying brakes to railway and other carriages.
344. John Mason and Samuel Thornton, Rochdale, and Thomas S. Sawyer, Longsight, Lancashire—Improvements in finishing or polishing and drying yarns or threads.
345. Henry Spencer, Rochdale—Improvements in machinery for preparing and spinning cotton and other fibrous substances.
346. Christophe F. Delabarre, Paris, and 32 Essex-street, Strand—Improved apparatus to be used in propelling gases and forcing liquids.

Recorded February 16.

347. William Spence, 50 Chancery-lane—Improvements in substitutes for glass for ornamental purposes.—(Communication.)
348. Eugène Carless, Stepney—Improvements in the manufacture of paper-cloth, known as artificial leather, and in coating or covering the surface thereof with colouring matter, said colouring process being also adapted to the colouring or staining of paper.
349. William Abbott, Lansdowne-place, Richmond—Invention of a boot and shoe cleaning machine.
350. William C. S. Percy and William Craven, Vauxhall Iron Works, Manchester—Improvements in the manufacture, and in machinery and apparatus used in the manufacture of bricks, tiles, pipes, and other articles made from plastic materials.
352. Hugh L. Pattinson, jun., Stotes Hall, near Newcastle-upon-Tyne—An improvement in the manufacture of wrought-iron tubes.
353. Fortunato G. P. M. V. Maneglia, of the Turin and Genoa Railway—Improvements in railway carriages.
354. Robert Blackburn and William L. Duncan, Wandsworth—Improvements in bleaching.
355. Samuel B. Wright, Stone, and Henry T. Green, Moreton, Staffordshire—Improvements in the manufacture of encaustic tiles.
356. Andrew H. Ward, jun., Massachusetts—Invention of a new and useful or improved loom temple.—(Communication.)

Recorded February 17.

357. James Wright, 16 Park-street, Kennington—Improvements in the construction of furnaces for the purpose of consuming more effectually than heretofore the smoke contained therein.
358. Henry P. Haughton, Bethnal-green—Improvements in a certain article of wearing apparel for the ankles.
359. John Hackett, Derby—A new and improved fabric or fabrics for the manufacture of umbrellas, parasols, and buttons, and for other purposes.
360. John Hackett, Derby—An improved leather cloth, and the employment thereof for various useful purposes.
361. John Oxley, Beverley, Yorkshire—Improvements in machinery for making wheels, or the various parts of which wheels are composed.
362. John Robb and Laurence Hill, Greenock—Improvements in the masts and spars of ships and vessels.
363. Robert J. Mary'on, 37 York-road, Lambeth—Improvement or improvements in the construction and application of steam engines, for the better means of transmitting motion and conversion of motion, and of applying motive power.

Recorded February 19.

364. George R. Chittenden, City—Improved apparatus for measuring fluids.
365. Richard A. Brooman, 166 Fleet-street—Improvements in the manufacture of capsules for stopping or covering bottles, jars, and other similar vessels, and in the machinery employed therein.—(Communication.)

Recorded February 20.

366. George Tillett, Clapham—Improvements in the construction of bedsteads.
367. David Hulett, Holborn—Improvements in apparatus for heating, cooking, and lighting by gas.—(Partly a communication.)
368. Samuel Bellamy, Torquay, Devon—Improvements in fire-arms and ordnance.
369. Charles R. Mead, Langdale-road, Peckham—An improved construction of gas regulator.
370. Albert L. Thirion, Asche en Refail, Namur, Belgium—Improvements in pumps.
371. Henry Schottlander, Paris, and 4 South-street, Finsbury—Improvements in ornamenting looking-glasses.
372. Samuel Kershaw and James Taylor, Heywood, Lancaster—Certain improvements in carding engines.
373. John H. Brown, 4 Trafalgar-square, Charing-cross—Improvements in the construction of ball-cartridges for facilitating the loading and lubricating of fire-arms.
374. Frederick B. E. Beaumont, Upper Woodball, Barnsley, Yorkshire—Improvements in fire-arms called revolvers.
375. Jean Wotbly, Zoffingen, Switzerland—Improvements in the preservation of meat.

Recorded February 21.

376. Joshua Kidd, Kildwick, near Bradford—Improvements in machinery and apparatus for sewing and stitching cloth and other fabrics.
377. Richard Laming, Carlton Villas, Maida Vale—An improved process for combining the purification of gas with the obtaining of certain valuable products.
378. Benjamin Goodfellow, Hyde, Chester—Improvements in machinery for pumping, which improvements are applicable to the air-pumps of steam engines and to other purposes.
380. Thomas Organ and George Pitt, Birmingham—A new or improved dress fastening.
381. George Nasmyth, Kennington, Surrey—Improvements in preserving animal and vegetable matters.
382. George Heppel, Preston—An improved rotary pump and engine.—(Communication.)
383. Frederick W. Norton, Edinburgh—Improvements in the manufacture of printed or coloured warp fabrics.
384. John H. Pidcock, Leighton Buzzard—An improved method of propelling and steering vessels, which is also applicable to the forcing and directing of liquids and fluids.
386. Frederic Prince, 3 South-parade, Chelsea—Improvements in fire-arms and ordnance.
387. William Maynes, Stockport—Certain improvements in self-acting temples to be used in weaving.
388. George Noble, Sunderland—Improvements in the manufacture of fire-bricks.
389. Paul Prince, Derby—An improvement in the patterns employed in making moulds for railway chairs.
390. Charles Low, Bodowen, Dolgelly, North Wales—Certain improvements in the extraction of gold from its ores.

Recorded February 22.

391. Thomas Harrison, Hackney—Invention of a composition for covering and protecting the bottoms of ships and vessels.
392. William Kirrage, 10 Edmund-street, Camberwell—Invention for consuming or burning smoke.
393. Robert M'Connell, Glasgow—Improvements in finishing or dressing textile fabrics.
394. James Bunten and George Lamb, Glasgow—Improvements in cutting and shaping wood.
395. Peter Clarke, Manchester—Improvements applicable to locomotive steam engines. (Communication.)
396. Walter Neilson, Glasgow—Improvements in locomotive engines.
397. Frederick W. East, 214 Bermondsey-street, Southwark, and John Mills, Old Kent-road—Improvements in destroying the noxious vapours arising from boiling oil, bones, and other matters in the open air.

Recorded February 23.

398. William Hartcliffe, Salford, and Joseph Waterhouse, Manchester—Certain improvements in looms for weaving.
399. Andrew Taylor, 21 Duke-street, Manchester-square—Invention of self-acting railway signals and apparatus connected therewith, for improving the means of communication between persons in charge of and the drivers of trains, and to render collisions less frequent on railways.
401. William J. M. Rankine and John Thomson, Glasgow—Improvements in machinery for laying subaqueous electrical conductors for telegraphic communication.
402. William H. Zahn, 13 Norfolk-street, Strand—Certain improvements in windmills—(Communication.)
403. Nicholas Bennett, 7 Furnival's Inn, Holborn—Invention of a substitute for the scaffolding at present employed in and for the erecting and repairing of buildings, which is also applicable in part to the ventilation of buildings.—(Communication.)
404. John E. Gardner, Strand—Improvements in portable cooking apparatus, and in cooking lamps.
405. Simon M. Allaire, Paris—Certain improvements in manufacturing hats, caps, and bonnets.
406. Benjamin Looker, jun., Kingston-upon-Thames—Improvements in ventilating stables and other buildings.
407. Nathan Thomson, jun., New York—Improvements in constructing life-boats.

Recorded February 24.

408. Victor J. Lebel, Jean Fournoil, and Jean B. Remyon, Paris—Improvements in typographic presses.
409. Barnaby A. Murray, Dublin—Improvements in winding, doubling, and twisting silk, flax, and other fibrous substances.
410. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in fountain pens.—(Communication.)
411. John H. White, Manchester—An improvement in the method of applying artificial teeth.
412. Joseph Player, John P. Player, and Luke D. Jackson, 2 Winchester-buildings—Invention of machinery or apparatus for drying tan peat and such like substances.
413. John S. Russell, Mill-wall—An improvement in the construction of ships or vessels to facilitate the use of water as ballast.

Recorded February 26.

414. William Brown, 113 Albany-road, Old Kent-road, Camberwell—Certain improvements in machinery for printing.
415. Hamilton Martin and Joseph Smethurst, Guide Bridge Iron Works, near Manchester—Improvements in the construction of fences or casings for shafts, pulleys, and other parts of machinery.
416. Auguste E. L. Bellford, 32 Essex-street, Strand—Certain improvements in the application of breaks on railways.—(Communication.)
417. Pierre A. Merchant, Paris, and 16 Castle-street, Holborn—Certain improvements in grinding mills.
418. Auguste E. L. Bellford, 32 Essex-street, Strand—Certain improvements in the manufacture of soda.—(Communication.)
419. James W. Spurway, Deptford—Invention of a travelling pass.
420. Alexander Brown, Tarbet, Dumbarton—Improvements in the manufacture of paper, and in the production of textile materials.
421. Charles H. Roberts, 3 Cornwall-road, Stamford-street, Lambeth—An improvement in the manufacture of rubbers for painters and others.
422. Thomas Nash, jun., 134 Great Dover-road—Improvements in painting brushes, applicable also to other brushes and to brooms.

Recorded February 27.

423. William A. Gilbee, 4 South-street, Finsbury, and Paris—An improved process of manufacturing alcohol from the stem and ear of maize.—(Communication.)
424. William A. Gilbee, 4 South-street, Finsbury, and Paris—An improved soap to which he gives the name of saponitoine.—(Communication.)
425. James Brodie, Bow of Fife—Improvements in and applicable to tongs, pliers, vices, and other holding instruments.
426. Alfred J. Berchtol, Paris—Certain improvements in applying the photographic engraving on metals or other materials.
427. Henry Gardner, 7 Arthur-street, Old Kent-road—Certain improvements in the construction of horse shoes, and in shoes used for the shoeing of hoofed animals.
428. Joseph Cooper, Birmingham—Certain improvements in joiners' braces, and in the mode of forming or partially forming the various bits to be used with such or any other kind of brace.
429. Benjamin Fothergill and William Weild, Manchester—Improvements in machinery for combing cotton, wool, flax, silk, and other fibrous materials.

430. William Campion, Nottingham—Certain improvements in knitting machinery.
431. Alexander T. Blakely, Little Ryder-street, St. James's—Improvements in ordnance.

Recorded February 28.

433. Alexander Symons, Strand—An egg-cooking apparatus.—(Communication.)
435. Frederic Allarton, High-street, Southwark—Certain improvements in the method of administering iron as a remedy.
436. Jesse Brickles, Thomas Thorpe, and Joseph Lillie, Manchester—Improvements in the manufacture of plain and ornamental woven fabrics.
437. James Higgin, Manchester—Improvements in treating certain waste soap liquors, and obtaining therefrom certain products applicable to purposes not hitherto known.
438. Ward Holroyd, Queen's Head, near Halifax—An improved method of fencing horizontal and other shafts in factories and other places where such fencing may be required for the purpose of preventing accidents.
439. Charles F. Stansbury, 17 Cornhill—An improved mode of ringing fog-bells.—(Communication from Charles G. Page, of Washington, in the United States of America.)
440. John Gedge, 4 Wellington-street South, Strand—Improvements in apparatus or machinery for stopping or retarding vehicles used on railways.—(Communication.)
441. George M. Miller and John Wakefield, Inchicore, Ireland—Improvements in pistons for engines driven by steam or other elastic fluid, which improvements are also applicable to the pistons or plungers of reciprocating pumps.
442. Benjamin W. Goode and Nebemiab Brougb, Birmingbam—Invention of a new or improved fire-arm.
443. Fischer A. Wilson, Kennington, Surrey—Improvements in closing and unclosing bottles and other vessels used for containing liquids, also in the modes of inserting, securing, and liberating liquids therein and therefrom.
444. Edward T. Bellhouse and Thomas Cowburn, Manchester—Improvements in vacuum valves and safety valves.
445. Henry C. Jennings, 8 Great Tower-street—An improvement in the manufacture of soap.
446. Thomas Cook, Addiscombe—Improvements in working punkas and apparatus for agitating air in churches, hospitals, and other buildings.
447. George Ritchie, Deptford—An improvement in the manufacture of linings for articles of dress.
448. Henry Penney, York-place, Baker-street, Portman-square—An improved mode of treating vulcanized or cured india-rubber.
449. Bewicke Blackburn, Clapham-common, Surrey—Improvements in the manufacture of pipes.

Recorded March 1.

450. Richard A. Brooman, 166 Fleet-street—An improvement in rollers used in spinning.—(Communication.)
451. John Ramsbottom, Accrington, Lancashire—Improvements in steam engines and obtaining motive power more economically.
452. Stanislas Vigoureux, Rheims, France—Certain improvements in printing, ornamenting, and dressing woven and textile fabrics.
453. Thomas Sadleir, Mulla, Tullamore—An improved apparatus and method of manufacturing charcoal, which can also be applied to cooking and other purposes.
454. George M. Miller, Inchicore, Ireland—Improvements in axles and axle-boxes of engines and carriages in use on railways.
455. Andrew Small, Glasgow—Improvements in marine compasses, and in apparatus applicable thereto.
457. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for rolling and shaping metals.—(Communication.)

Recorded March 2.

458. James Lewis, Abergavenny, Monmouthshire—Improvements in stench-traps.
459. Thomas Dodds and Richard Leake, 4 Horse-shoe-court, Ludgate-hill, and William Fletcber, 2 St. James's-street, Old Kent-road—Certain improvements in the construction of a machine for heating all kinds and description of furnaces with coal or other gases.
460. George Lowry, Manchester—Improvements in machinery for preparing and spinning flax, hemp, and other fibrous materials.
461. Constant J. Duméry, Paris—Improvements in alarm and safety whistles for steam generators.
462. Charles F. Stansbury, 17 and 18 Cornhill—An improved drill and bit stock.—(Communication.)
463. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in slide valves for steam engines.—(Communication from Erasmus D. Leavitt, the younger, of Lowell, in the United States of America.)
464. William Hodges, Stafford—Certain improvements in boots and shoes.
465. John Johnson, Bow, Middlesex—Improvements in temporary rudders.
466. William G. H. Taunton, Liverpool—Improvements in pumps, pump gear, and pump buckets.
467. Alfred V. Newton, 66 Chancery-lane—Improvements in the construction of printing presses.—(Communication.)
468. John Coney, Newhall-bill, Birmingham—An improved construction of gun lock.

Recorded March 3.

469. John Woodley and Henry H. Swinford, Limehouse, Middlesex—Improvements in apparatus for indicating and giving alarm in cases of fire.
470. André B. Vabre, St. Thomas'-street East, Surrey—Improvements in floors and roofs.—(Communication.)
471. Benjamin Dickinson and John Platts, Clough-house-mill, near Huddersfield—Improvements in machinery or apparatus used in finishing woollen and other textile fabrics.
472. William Hunt, Tipton, Staffordshire—Improvements in utilizing certain compounds produced in the process of galvanizing iron, and in the application of the same and similar compounds to certain useful purposes.
473. Thomas H. Ryland, Birmingham—An improvement or improvements in the manufacture of neck and dress chains, bracelets, and other ornamental articles of dress, and in links used in the manufacture of the said chains and other ornamental articles of dress.
474. William Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in cleansing and preparing fibrous materials—(Communication from Samuel W. Brown, of Lowell, Massachusetts, in the United States of America.)
475. Joseph Revell, Dukinfield, Cheshire—Certain improvements in machinery or apparatus for propelling vessels.
476. John O. Williams, Torquay, Devonshire—Improvements in camp stoves and cooking apparatus.
477. Thomas Metcalf, High-street, Camden-town—Improvements in window sashes.
478. Robert Boby and Thomas C. Bridgman, Bury St. Edmunds—Improvements in corn-dressing and winnowing machines.
479. Timothy W. Carter, Massachusetts, U.S.—New and useful improvements in repeating fire-arms.—(Communication from Joshua Stevens, of the aforesaid State of Massachusetts.)
480. Charles Iles, Birmingham—Improvements in apparatus for cutting, burnishing, and polishing cylindrical surfaces of metal and other substances.
481. Charles Iles, Birmingham—Improvements in the manufacture of tubes, knobs, and handles of doors, rollers of castors, and reels for cotton and thread.

Recorded March 5.

482. John Gledhill, Congleton, Cheshire, and Robert Gledhill, Halifax, York—Improvements in the preparation of silk, flax, and other fibrous substances, and in the machinery or apparatus employed therein, part of which is applicable to the preparing of wool for combing.
483. Lewis J. Paine, Camberwell, and John Ryan, Hatcham—Improved portable utensils, such as buckets, canteens, baths, and other similar waterproof articles for containing liquids; also applicable for portable life-boats, buoys, or landmarks, and other compressible articles.
484. William Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in coating iron and steel wire with other metals or alloys.—(Communication from Alexandre Désiré Eugene Boucher and Adrien Muller.)
485. John Dawson, Northwich, Cheshire—An improvement in saddles.
486. Andrew Hotchkiss, New York—Improvements in projectiles.
487. Richard A. Brooman, 166 Fleet-street—Improvements in projectiles.—(Communication.)
488. Arsène L. Garnier, Guernsey—An improved process for producing photographic pictures, which he intends to denominate Système Garnier de Photochcrographie coloriée.
489. John Lewis, Elizabethtown, New Jersey, U.S.—Improvements in rigging and sparring vessels.
490. Richard Van Valkenburgh de Guinon, Brooklyn, New York—Improvements in anchors.
492. James Wood, 30 Barbican—Improvements in ornamenting woven fabrics for bookbinders and others.
493. Auguste E. L. Bellford, 32 Essex-street, Strand—Certain new and useful improvements in the oscillating steam engine.—(Communication from John A. Reed, of New York, in the United States of America.)

Recorded March 6.

494. William Hyde, 17 Cornhill—Improved marine life-preserving apparatus.
495. William Jenkins, Neath Abbey, Glamorganshire—An improved method of casting copper cylinders, copper vessels, and other copper forms.
497. George W. Bowlsby, Oxford-street,—An improvement in closing the windage when discharging cannon.
498. Joseph Player and Luke D. Jackson, 2 Winchester-buildings—Improvements in the construction of furnaces for the prevention of smoke.
499. Adam J. Burr, 42 Alfred-road, Paddington—Improvements in gas meters.
500. Thomas Lawson and Matthew Thompson, Gateshead—Improvements in the consumption and prevention of smoke.
501. Eugène Tardif, Bruxelles, Belgium—An improved construction of numbering apparatus.

Recorded March 7.

502. John Kennedy, Liverpool—Improvements in the manufacture of boots and shoes.
503. James Higgins and Thomas S. Whitworth, Salford—Improvements in the manufacture of small arms, part of which improvements is also applicable to hardening other articles of metal.
504. Joseph Cooper, Birmingham—Certain improvements in joiners' braces, and in the mode of forming or partially forming the various bits to be used with such or any other kind of brace.
505. William Weild, Manchester—Improvements in looms or machinery for weaving pile fabrics.
507. John W. Slougbgrove and James H. Wheatley, Windsor-street, Islington—Improvements in smoke-consuming furnaces.
508. James M. Napier, York-road, Lambeth—Improvements in machinery for manufacturing balls or projectiles for small arms.
510. John Wilson, Hurlet, Renfrewshire, and John Horsley, Cheltenham—Improvements in the manufacture of iodine and iodides, and of a pigment or pigments from certain residual products in such manufacture.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

DESIGNS FOR ARTICLES OF UTILITY.

Registered from Feb. 10 to Feb. 26, 1855.

Feb. 10th,	3683	Mége and Zaehns-dorf, Frith-street,—"Bracelet-clasp."
13th,	3684	Clark and Timmins, Birmingham,—"Lamp-iron."
20th,	3685	Price's Candle Company, Vauxhall,—"Stove-lamp."
21st,	3686	Oakes and Ward, Birmingham,—"Lamp-handle."
22d,	3687	Smith and Ashby, Stamford,—"Mill-frame."
23d,	3688	Price's Candle Company, Vauxhall,—"Stove-lamp."
26th,	3689	Hinks and Wells, Birmingham,—"Penholder."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered.

Feb. 10th,	638	W. Graham, Cheapside,—"Brace-ends."
17th,	639	W. B. Flint, Birmingham,—"Shutter-bar clip."
19th,	640	Harris and Sons, Long Crendon,—"Sail needle."
20th,	641	E. B. B. Wren, Tottenham-court-road,—"Camp arm-chair."

TO READERS AND CORRESPONDENTS.

Smokeless Furnace for Steam-Boilers.—This patented invention, illustrated and described by us last month, is the joint invention of Messrs. J. B. Jackson and W. Bowler. In our notice, Mr. Bowler's name was inadvertently omitted.

Commencement of the 8th Vol. of the Practical Mechanic's Journal.—The present part, No. 85, commences the 8th volume. The entire set of 7 volumes, as issued, may now be had from any bookseller, in cloth, lettered in gold, price 14s. each; or the whole 84 parts may be purchased, as originally published, at 1s. each. The first six volumes may also be had, handsomely bound in half-calf, in three double volumes, with the Plates bound separately to correspond. Price 31s. 6d. for each double volume and volume of Plates. Vol. 7 contains 27 quarto pages of Copperplate Engravings and 500 Engravings on Wood, with 296 pages of Letterpress.

W. S. (Carluke.)—An invention, once fully published, cannot be patented.

H. B. S. L. (London.)—We are afraid we cannot at once direct him to a satisfactory published examination of the point at issue. The tensional strain will result in two actions--a direct longitudinal pull and a lateral bending. The obvious consequence is, that whilst the parts intersected by a transverse central line are subjected to a tensional strain in a direction parallel with the fibres of the metal, the parts just clear of the holding links at each side are acted upon by a sharp lateral bending strain in addition. When the metal is uniformly good throughout, fracture invariably occurs at these sharp bends.

Rio Dolce.—The proportion of the circular to the square inch is as ·7854 to 1, and it is sometimes convenient to adopt this relation. If he gives us a case in point, we will assign a reason for it.

T. D. (Sheffield.)—The sketch shows no self-acting valvular apparatus, which, in the invention to which he refers, is the essential point.

CO

RAIL

BY

MESSRS TAYLOR & CRANSTOUN.

MORAYSHIRE RAILWAY.

ELGIN.

Fig. 2.

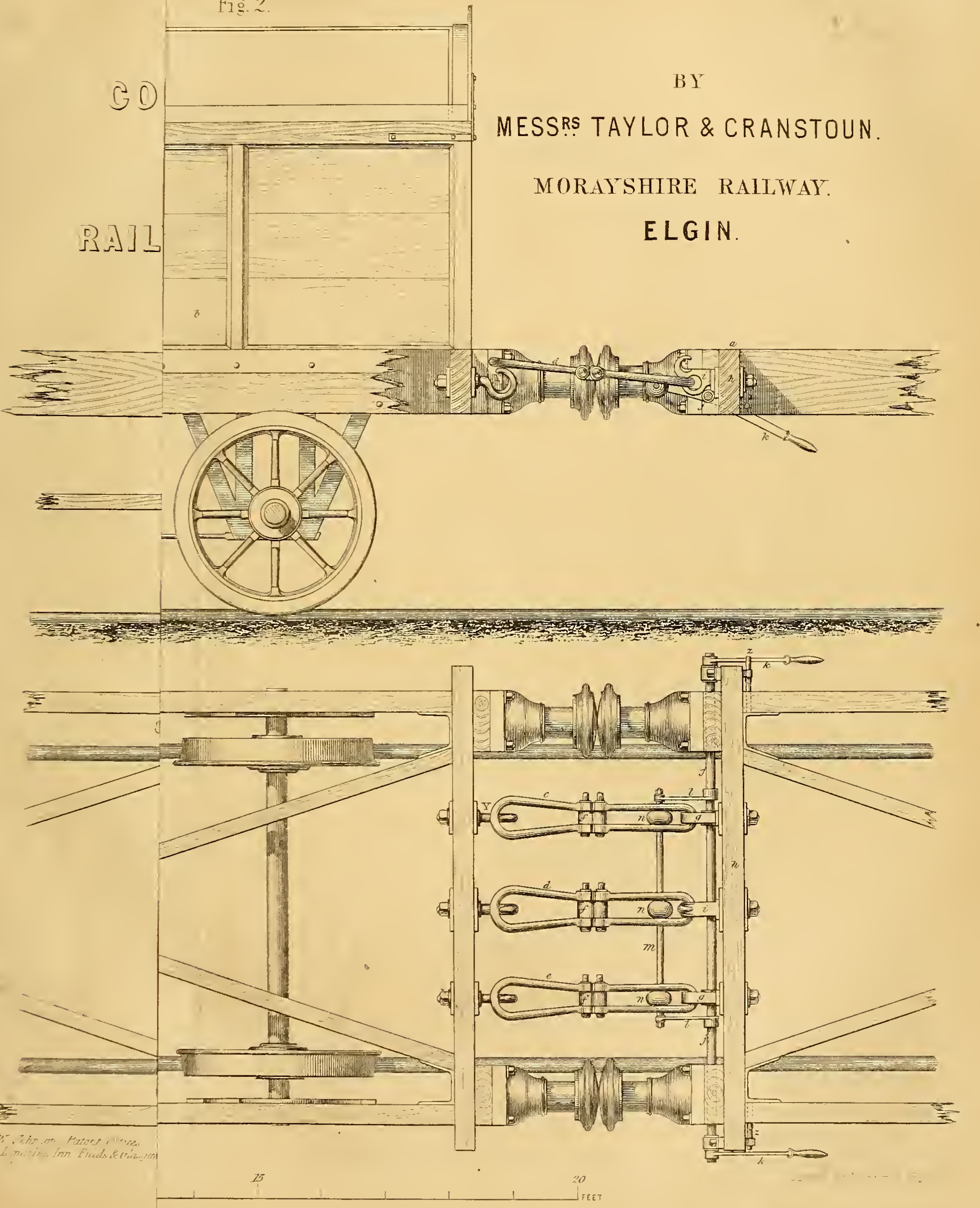

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Plate 170.

Vol. VIII.

COUPLING GEAR
FOR
RAILWAY CARRIAGES.

BY
MESSRS TAYLOR & CRANSTOUN.
MORAYSHIRE RAILWAY.
ELGIN.

Fig 1.

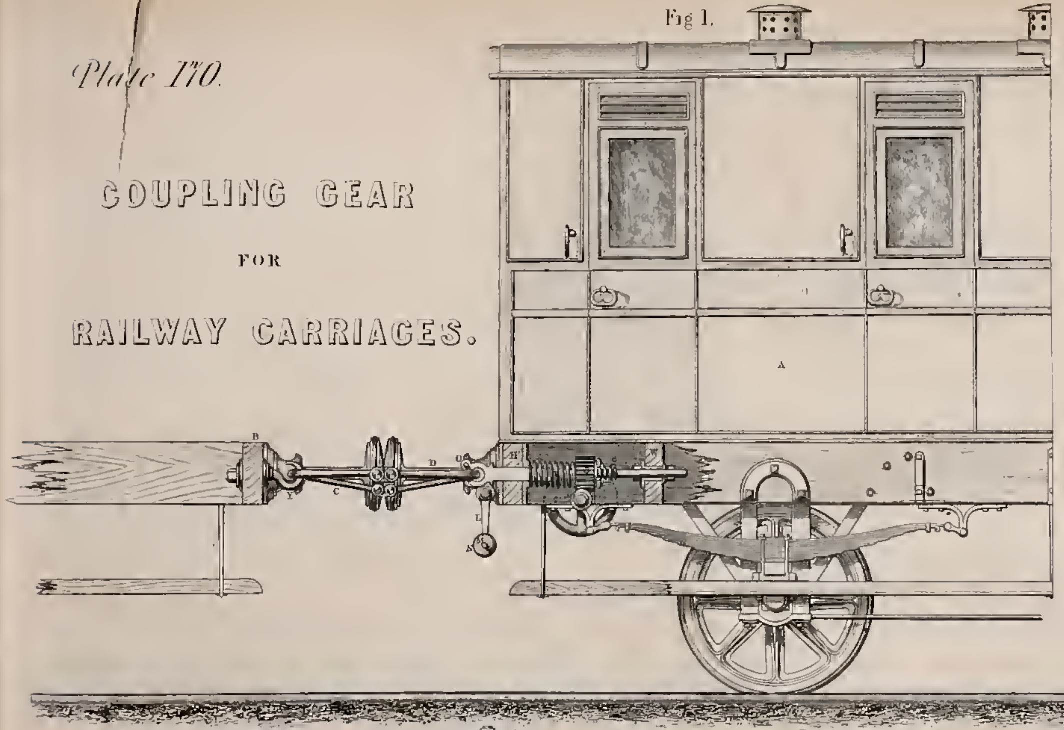


Fig. 2.

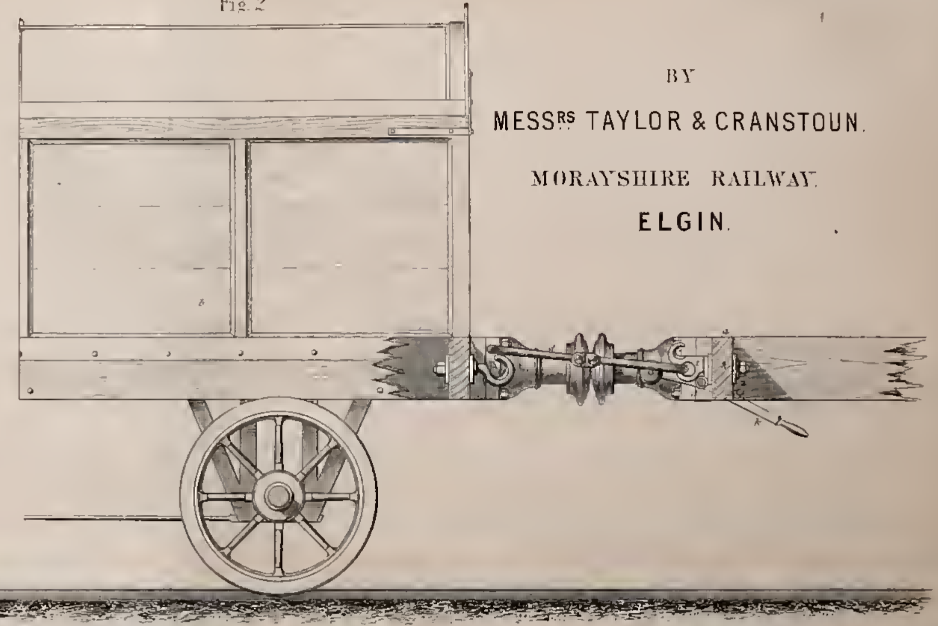
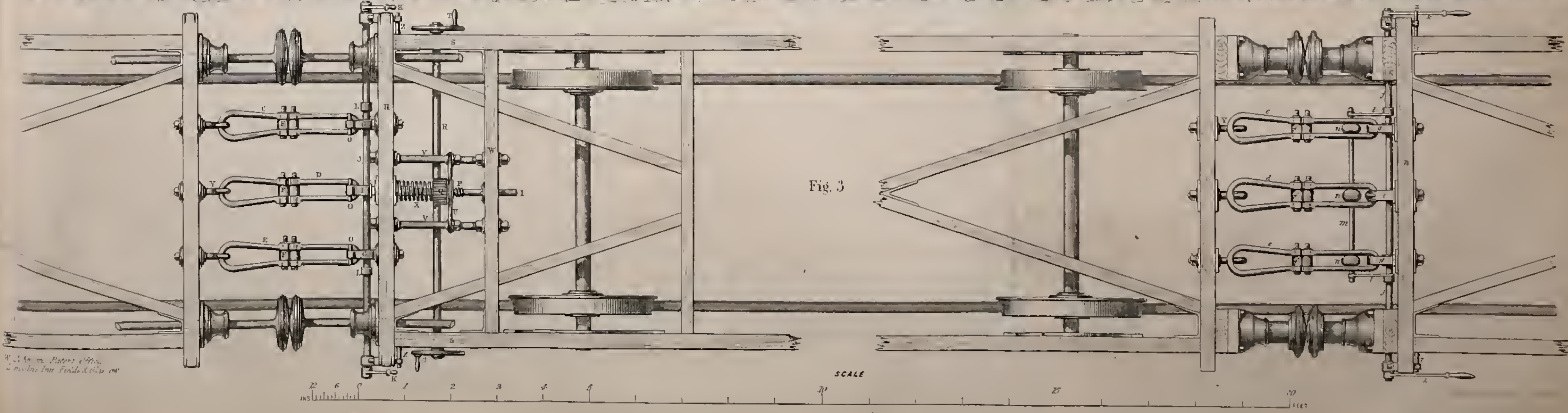


Fig. 3.



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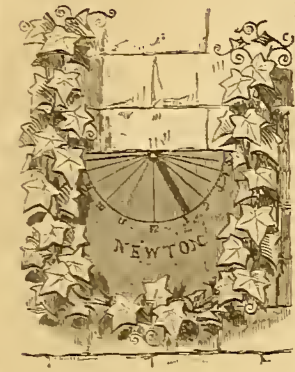
IV.

THE ROYAL SOCIETY.



YOUNG NEWTON'S STONE MURAL SUN-DIAL, AGAINST THE MANOR-HOUSE OF WOOLSTHORPE, HIS BIRTHPLACE.

UPON the resignation of Sir John Pringle, Sir Joseph (then Mr.) Banks was elected President—a botanist and little more. How he acquired his love for the study was related by him to Sir Everard Home. One fine evening be had been bathing with other boys, but having remained a long time in the water, when he had dressed, all his companions had gone home. He proceeded leisurely along a lane, the sides of which were richly enamelled with flowers. These attracted his attention, and gazing earnestly at them, he involuntarily exclaimed, ' How beautiful!' and, after some reflection, added, ' It is surely more natural that I should be taught to know all these productions of nature in preference to Greek and Latin; but the latter is my father's command, and it is my duty to obey him: I will, however, make myself acquainted with all these different plants for my own pleasure and gratification.' This was a rare resolution for one with an expectancy, which he came into immediately after he took his degree at Oxford, of £30,000 a year. Reader! have you not the whole man before you? Perhaps John Hunter summed up Banks' character justly. He used to say, if any man was to be envied, it was he; for he was engaged in the most rational pursuits that can occupy the mind of man; his income enabled him to carry them on without embarrassment, the sublimity of their nature and the vastness of their extent made it impossible for him to tire or be out of employment.

It is to the very great credit of Banks that, in 1767, returning from a voyage, he should have brought the first specimen of caoutchouc to England. He called it a new elastic substance. It is somewhat remarkable how many years it was before it received its present adaptable form!

Our readers will remember that Sir Joseph Banks was a companion with Cook in one of his voyages, and the founder of the African Association, and that, by his will, he bequeathed his extensive collections, library, &c., to the British nation. He died as recently as 1820, full of years and honour, having, in every possible way, for above forty years, presided over the interests and administration of the Society.

Rather a funny thing occurred on the death of Banks. He had left his wealth to his widow, and made her residuary legatee. One of the secretaries of the Society found a delicate balance by Ramsden, which had belonged to Banks, lying in the apartments. He wrote, apprising the widow that the balance was there, and requesting to know her wishes respecting it. Her ladyship replied, " Pay it into Coutts'." It is to be lamented that, possessing, as he did, so immense a private fortune, he should not have benefited the funds of the Institution over which he presided so long, and in which, from his very boyhood, he had evidently taken so great an interest. Let us hope it arose simply from the habit of deferring to to-morrow what might be as well done to-day.

The Royal Institution owes its origin to Fellows of the Royal Society. It was incorporated in 1800. It is not the least of the triumphs of the parent Society, to see this comparatively recent establishment so flourishing. In some earlier pages we have detailed its truly grand career, and to those pages we must refer the reader seeking further information respecting it. It must be sufficient to remark here, that the great interests of discovery so efficiently advanced by Sir Humphry Davy, and so much further promoted by the brilliant services of Faraday, are not likely to remain stagnant with the latter in the full vigour of his intellect, and the judicious enthusiasm and industry of Professor Tyndall. Ever since the establishment of the Royal Institution, it has been considered as the workshop of the Royal Society. Here theories and speculations are broached—there they are tested by experiments, and the results comprised in a long series of contributions to the Philosophical Transactions, sufficiently record with what success, whether in dissipating error or disseminating truth.

In 1806, Sir Humphry Davy's celebrated paper ".On some chemical agencies" was read. It is gratifying to our national vanity that it was crowned by the Institute of France, and a prize of 3000 francs awarded to Davy, although that country was then at hot war with us.

Davy was shortly after elected Secretary of the Royal Society, with Wollaston and Young as his colleagues.

At no period of its career did the Society receive more lustre than from the researches of Dr. Thomas Young, particularly those which led to the promulgation of the undulatory theory of light. Young was the foreign secretary to the Society from 1804 to 1829.

In 1807, another offshoot showed itself in the Geological Society, then established. It is remarkable that its early meetings should have taken place at seven o'clock in the morning—being the only hour at which Dr. Babington, its founder, could attend. That this early time of meeting in the day did not damp the energies of the members, is obvious from the constantly increasing popularity of the Society.

In 1817, the North-West Passage—that is, the passage from the Atlantic to the Pacific Ocean along the northern coast of America—became a topic of great interest, owing to a communication made by Mr. Scoresby to Sir Joseph Banks, in which it was assumed that new sources of warmth had, by some natural causes, been opened in the regions of the Arctic circle, by means of which the cold, which had for centuries past enclosed the seas in the higher latitudes in an impenetrable barrier of ice, had been, during these last two years, greatly abated, and the ice no longer seen. This led to all the subsequent and ever-to-be-deplored recent disasters. The Royal Society took the matter up with its usual enthusiasm, as it had done the preparation for the previous expedition of Captain Phillips, afterwards Lord Mulgrave. Poor Sir John Franklin was a lieutenant at the time, and was appointed to the *Trent*, 250 tons, under Captain Buchan, of the *Dorothea*, to trace the Polar passage. This was Franklin's first Arctic voyage. The ships sailed on the 18th of April, 1818, and the celebrated *Hecla* and *Griper* were sent out on the same unfortunate errand on the 11th May, 1819, under Sir Edward (then Lieutenant) Parry.

The venerable President, Sir Joseph Banks, died in June, 1820. A statue in marble, by Chantry, was subscribed for, and it is now in the hall of the British Museum. Upon his death, Dr. Wollaston was elected President. It was Wollaston who discovered the curious metals, palladium and rhodium, and the method of rendering platinum malleable, by which, it is said, he made £30,000. His reflective goniometer is well known. His camera lucida is still in constant use. To him we owe the first demonstration of the identity of galvanism and common electricity, and the first explanation of the cause of the different phenomena exhibited by galvanic and common electricity. He presented the Society with the munificent sum of £2000. He died, lamented, in 1828. The facts mentioned in these few lines, constitute a noble monument to his memory.

In 1820, the Astronomical Society became established, taking off much of the work of the Royal, as originally designed,—another little colony thrown forth into the world by this great parent Society, and now, happily, flourishing prosperously. Much opposition was at first made by some of the fellows to the establishment of a Society which would obviously engross much of the mathematical department, for which, ever since the publication of the great " Principia," it had become famous wherever science was appreciated. But, really and truly, the British Museum, the Geological Society, the Linnæan Society, the Zoological Society, the Astronomical Society, may be considered but as committees of larger growth, acting under its direction—a direction which must obviously ever be exactly similar to that of the executive of each.

With all these offshoots, it had still its work to do—its great labourers to reward or sympathise with.

In 1820, the Copley medal was awarded to Oersted of Copenhagen, for his brilliant discovery of electro-magnetic action.

On the death of Wollaston, Sir Humphry (then Mr.) Davy was elected President, and no man, probably, more deserved the honour. His discoveries have put on the robes of usefulness and comfort, and travelled into and domiciled in all lands, for where have the benefits of those which he made in chemistry not been felt, although the people may be ignorant of the hand that really furnished them forth?

The great question relating to the pendulum had some time before this been raised. It was ascertained that the pendulum vibrating seconds in the meridian of Greenwich, measured, according to Bird's Standard (1758), 39·1393 inches, and of these, 36 were taken to be the standard yard measure of the British Empire for ever. In like manner was a uniformity of standard weights obtained by adopting the old standard of troy, and raising the avoirdupois weight from this basis. It was enacted by Parliament in 1823, that a cubic inch of distilled water in a vacuum, weighed by brass weights also in vacuum, at the temperature of 62° Fahrenheit, should be considered equal to 252·724 grains, and that the standard troy pound should contain 5760 of such grains, and the standard avoirdupois pound 7000 of such grains, and that subdivisions should be made accordingly. This had all been effected through the instrumentality of the Royal Society, and the honour attendant upon it exclusively belongs to them as a body.

The Society, who had for some years been visitors of the Greenwich Observatory, ceased to be so, upon the demise of William the Fourth, although the body of visitors since, and now constituted, comprise the President and several of the Fellows for life.

In 1825, two Royal medals were furnished by George the Fourth, under the secretaryship of Sir Robert Peel, to be awarded annually for great scientific discoveries. Both medals are of the value of £50 each in gold. The first gold medallist, in 1826, was John Dalton. It is rather amusing, however, to remember that, from several reasonable causes, although the adjudication of ten medals in half as many years had been successively made, not even the dies had been constructed! This was subsequently remedied A duplicate medal in silver is always given with that in gold.

Sir Humphry Davy resigned the president's chair. How he had filled it may be inferred from an extract from his private note-book, made when he was twenty, on leaving home:—"I have neither riches, nor power, nor birth to recommend me, yet, if I live, I trust I shall not be of less service to mankind and to my friends than if I had been born with those advantages." His name is as a fame in all the world. His early patron, Mr. Davies Gilbert, was immediately unanimously elected president—Davies Gilbert ("the first student of his class who had ever read the *Principia*"). Royalty shortly after disdained not to take the place of Mr. Gilbert on his retirement, in the person of the amiable Duke of Sussex, whose intimate relation with parties in power enabled him to forward, to a great extent, the interests of the Society.

The Society acquired increased accommodation in 1826, when, on the suggestion of Sir Robert Peel, the rooms formerly occupied by the lottery commissioners were granted.

The library contains about 50,000 volumes. The Arundel MSS. formerly belonged to it, but in 1830 they were sold to the trustees of the British Museum for £3,559, which sum was expended in the purchase of scientific books. A good printed catalogue of the books was made during the time Mr. Wm. E. Shuckard (of entomological repute) acted as librarian. The library is open for fellows every day, except Sundays and the usual holidays.

The number of fellows is about 900, and during the session, which is in the winter season, weekly meetings are held, when papers are read, and the fellows and visitors subsequently retire to the library for conversation and the refreshment of tea and coffee.

The Society is fortunate in the possession of some hundred acres of land, and about £30,000 in the public funds. The donation fund, originated by Dr. Wollaston, amounted, in 1848, to £4,843.

In a Society so eminent as this—as ancient almost, indeed, as it could be, being founded not long after the promulgation of the inductive philosophy—it cannot be expected that its long life should have been without disturbance. From all invasions from without, it was necessarily free. Its essential missionary spirit was security against them, and, theoretically, internal convulsions could have no place. But the Society was composed of men, and wherever men are, power, passion, and prejudice will occasionally create that which is not convenient. So it was with "The Royal," as it is now called in town. But these unpleasantnesses have been of rare occurrence, and not of long duration when they have occurred; and it is as characteristic as it is agreeable to remember that the petty factions of two or more of the fellows have invariably terminated in closer friendships and more generous rivalry in advancing the great interests of mankind in general.

Among these may well be reckoned the recent trigonometrical surveys; Sir Humphry Davy's protector for sheathing; Mr. Babbage's calculating machine; Sir William Snow Harris's lightning conductors for ships; glass for optical purposes; the London gas-works, and the terrestrial magnetic observations; many of the subjects introduced by Government, and all meeting with the promptest attention. The Society had also imposed upon it the whole arrangement about the celebrated Bridgewater Treatises.

Very much more could we say respecting it, but our columns have been occupied so long with the subject that we feel compelled to desist. We must not, however, conclude without adverting to the storehouse of facts, which we have largely drawn upon, in Mr. Weld's very excellent volumes on the History of the Royal Society.

AMERICAN NOTES.

BY OUR OWN CORRESPONDENT.

New Building Material—Iron Smelting—Randall & Jones' Corn-Planter—Brown's and Babcock's Presses for Printing in Colours—Jones' Typographer—Ames' Copying Machine—Stetson's Writing Engine.

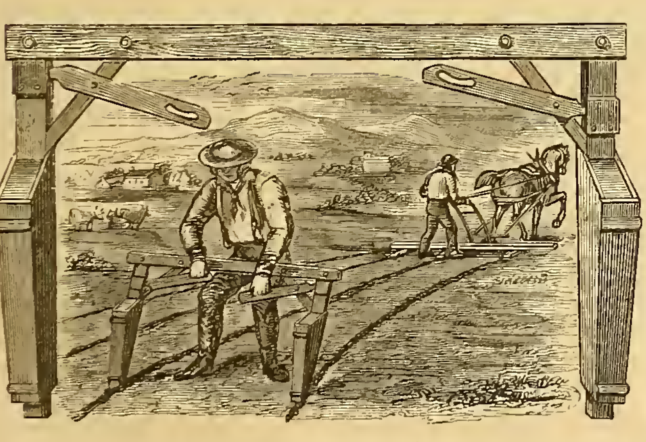
A new brick has been added to the long list of existing building materials. Mr. Ambrose Foster, of Portland, Dodge county, Wisconsin, deserves the credit of originating the production of a dry-pressed article of this class, differing materially from its predecessors, and promising to be of great value, on account of the cheapness and general diffusion of its component materials. "Grout" is a term familiar to every mason, meaning a mixture of lime, sand, and water, forming a kind of fluid mortar. Grout is sometimes poured over a work of stone or brick to fill the interstices, and, in a less fluid condition, has been often employed in those parts of our western country where lime and sand are plentiful, to form, *in toto*, the external walls of buildings. Very hard and durable buildings are thus constructed, by pouring the plastic material between boards suitably arranged; and this process seems to have suggested the present form of the new building material. Mr. Foster, who is a mechanic of considerable note, takes eleven parts of damp sand, fresh dug, and mingles therewith one part of lime, in the powdery state which it assumes after being slacked. This dry, or nearly dry material, is then subjected to a great pressure in suitable moulds, and comes out a white artificial sandstone. These artificial masses are then piled up in such manner that the air may circulate freely around them, and they are soon hardened into bricks, suitable for all ordinary purposes. In their manufacture they neither shrink nor warp; and hence they can be laid so evenly, that little more time is required to make the bricks and put them together, than is now consumed in merely laying up an ordinary brick building, in which the bricks are baked from clay. Sand being

being much more plentifully distributed over the globe than clay, it follows that the buildings are proportionably cheaper; and as the process of hardening continues to progress for several years, the wall finally becomes nearly indestructible. The internal surfaces of these walls are also much smoother than common walls, so much so, that, with proper care, they present a very handsome finish without the aid of plastering. These bricks probably undergo the same chemical change as is experienced by grout or common mortar on being exposed to the air; that is, the lime absorbs from the atmosphere the carbonic acid which was driven off in the process of burning, and changes back again into stone, while the sand performs a part, the theory of which is not yet fully explained. The great strength and hardness of these bricks, when exposed only for a few days in the piling process, enables them to be manufactured with perforations, so that all the advantages of hollow bricks may be fully realized, without detracting seriously from the strength of the wall. Clean, pure sand is preferable, but a slight admixture of clay or other earths may be compensated for by a freer admixture of lime, and metallic oxides may be employed to give any shade of colour required, or to produce the variegated appearance of marble. The material is said to have been subjected to almost every variety of test with complete success, and the process has been patented both in our own country and in Great Britain.

Mr. T. Selleck, of the Sussex Zinc Mines, New Jersey, has recently perfected a new process for fusing the ore known as *Franklinite*, whereby the iron comes out of the furnace a beautiful and excellent pig, worth 50 dollars per ton; whilst the zinc is sublimed and condensed as a yellowish-white powder, worth in that form about 100 dollars per ton. One hundred tons of this ore, as picked up in boulders on the surface, yields about 20 tons of iron, and 30 tons of the zinc powder, the latter being chiefly used for paint. The single furnace now in use is represented as capable of fusing about 10 tons of ore per day.

In Part 84 of this Journal, there were given particulars of a corn-planter, which "punches" the grain into the earth, and allows the hole to fill itself at its leisure, after the removal of the instrument. Messrs. Randall & Jones, of Rochford, Illinois, have introduced one on a somewhat similar principle, but which is still simpler and cheaper, considering the fact, that it plants two rows at the same time. The exterior of this planter is represented in fig. 1, constructed chiefly of wood, the whole affair complete, weighing, when uncharged with seed, about 10 lbs. The cut represents the machine itself in the foreground, a man using one at a little distance, and another labourer, in the background, "marking" the ground, by the aid of a horse and a "marker." The field is always cross-marked, and the hills of corn are placed in the angles, to allow of subsequent cultivation by machinery. The simplicity of this planter, the certainty and rapidity of its operation, and its apparent freedom from the possibility of derangement, alike commend it to favourable notice.

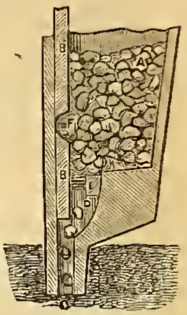
Fig. 1.



As in the planter previously noticed, the only motion required from the labourer is simply to press it down upon the proper location. The levers with which the operator's hands are more immediately engaged, are connected, at their other extremities, to slides of wood, some half-inch in thickness, and the simple vertical movement of these slides, at each downward thrust of the machine, deposits the seed in its place, and measures off the right quantity for the next hill.

The boxes for containing the grain to be planted are conspicuous on each side the levers for working, and the upper ends of the slides are equally so; but the device by which the measuring and dropping is performed is within, and concealed from view. Fig. 2 is a sectional view of this portion of the apparatus, A being the lower portion of the seed-box, B the lower extremity of the slide, and C the extreme base of the machine, which serves as a punch for producing the hole in the earth. The slide, B, when in its lowest position, fills the space in its interior, and enables it to imprint a fair rectangular cavity to a suitable depth in the earth. As the hands continue to press down the levers, releasing their hold upon the cross bar, the machine itself remains for the moment stationary, but the slides ascend into the position indicated in fig. 2, allowing the grain in the cavity, D, to descend into the earth. The elevation of the hands of the workman brings down the slides to their proper position, and, in doing so, fetches down, past the small brush, E, as much grain as can be contained in the cavity, F. The dimensions of this cavity, F, can be increased or diminished at pleasure, so as to regulate the number of grains planted at each movement, and the introduction of the brush, E, is an excellent means of preventing the crushing or splitting of those grains which have only partially entered the cavity. By this machine the grains are planted in close contact with each other, or rather are distributed along a very small parallelogram in the earth; but this is claimed to be in nowise detrimental to the crop, the stalks always spreading themselves to a suitable distance apart in growing.

Fig. 2.

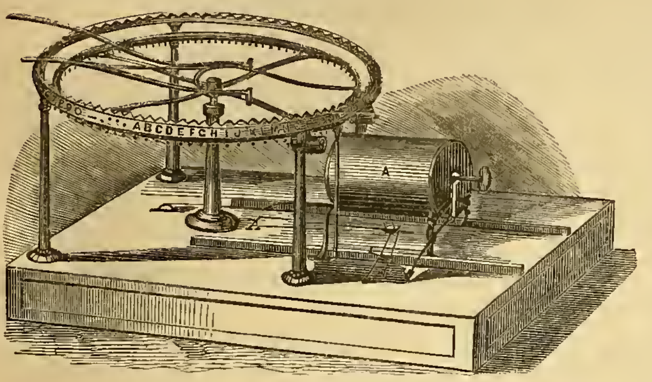


Printing in colours is an art which has been carried to great perfection by several processes, and several machines have been lately devised for cheapening and expediting the work. Mr. Samuel Brown, of Syracuse, N.Y., patented a press, the practical operation of which is little known beyond its immediate locality, but which is capable of printing four colours at one impression, and will throw off about 500 impressions per hour. The press is on the "platten," or "flat impression" principle, and in general appearance it somewhat resembles what is here known as the Adams' press. Each coloured ink is distributed on a separate roller, and all move horizontally across the form at the same time, but at different levels; the blue roller, for example, being beneath the black, and the yellow and red ranging still further below. Those portions of the "form" which are to be of any given colour are "locked up" in separate small "chases," and as the bed of the press sinks down after each impression, these chases are stopped by pins projecting from the sides, each at their proper level, to receive the desired colour. Only one of these presses is yet in operation; but, although evidently somewhat clumsy, and liable to derangement, the specimens of work done are very creditable, and give promise of very favourable results in the coarser kinds of coloured work.

A polychromatic press, far superior to this for every variety of small work, has been patented and set in successful operation by Messrs. A. M. & G. H. Babcock, of Westerly, R.I. In this press the paper is laid on a revolving cylinder, or rather parallelopiped, with four flat faces, and it is firmly held by the usual means. The paper is laid on the upper face, after which a quarter revolution presents a new face to receive paper, and presents the paper already laid to the action of a form which moves horizontally from the side. Another quarter revolution presents this first sheet to the action of another form, rising from beneath, of a different colour, and a third movement gives it a third impression. A fourth movement presents it at the top again, when the printed sheet is removed, and another laid on. The three forms, one form on each side, and one form beneath, move up simultaneously against the three faces, whilst the hand of the attendant is occupied in changing the paper on the fourth. The inking rollers, of which, of course, a separate set is provided for each form, perform their duties admirably, moving once backward and forward over the form, whilst the paper cylinder is changing positions. The "register" of this press is perfect, a point of the first importance in colour printing, as the slightest misplacement of an impression frequently ruins what would otherwise be a fine effect. The work is performed rapidly and well, yet without violent motions or concussions, and the number of inks employed is three, although, by a trick well known to the craft—allowing some lines to receive two full and perfect impressions, thus superposing one colour upon another—six actual varieties may be produced. Patents for the United States have been secured, and measures are taken to secure patents for the British islands.

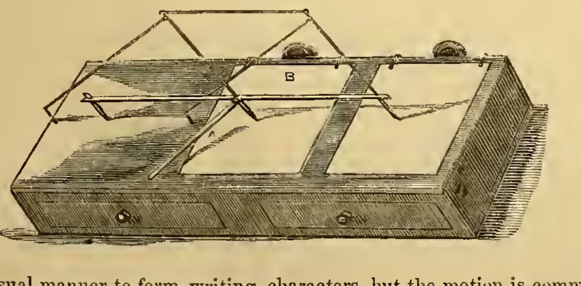
The "typographer" is a machine differing essentially from other printing apparatus, except that the appearance of the work produced is very nearly the same. The typographer, in short, is an invention by which cards, notes, envelopes, communications of all kinds, and important documents, may be printed by a slow process of producing one letter at a time, as in ordinary writing. Fig. 3 is intended to represent the machine complete, which is light and portable, and may be placed on, or deposited within, any ordinary writing-desk.

Fig. 3.



The paper to be printed is wound upon the small cylinder, A, and is fed forward by suitable mechanism, not fully represented in the engraving, but all automatic. A horizontal ring or wheel of about twelve inches diameter is fixed on a vertical shaft, with liberty to revolve freely, and also to move vertically. To the circumference of this ring are attached, at equal distances, all the letters of the alphabet in succession, with the addition of numerals and capitals. The faces of all these types are directed downward, and the paper cylinder is so placed underneath, that, on depressing a lever connected with the type wheel, the paper receives a distinct impression from one, and one only, of the types, and by moving the lever horizontally in either direction, any required letter may be thus produced. To insure accuracy of position in this respect, and also to facilitate rapid manipulation, a device has been adopted, which may be better inferred from the cut than from description, consisting substantially of a stout ring of cast-iron, fixed on suitable standards, just exterior to the type wheel, and having its upper surface filed into plain triangular notches, to receive the lever when depressed. Each notch corresponds to a letter or figure on the type wheel; and to aid the hand in finding correctly the true position before depressing the lever to the point of actual contact between the type and the paper, the lever is made double, as represented, the lower portion being held by a delicate spring, so much lower than the hand, that it falls readily into the notch, and guides the upper or true lever in its descent. The machines complete can be manufactured at a price which will allow of their employment for children's toys, and perhaps nothing can well be devised to be more instructive and entertaining to a vigorous and ingenious boy than the possession of such an instrument. The inking is performed by two small rollers, which are continually pressed against the lower surface of the type wheel, and necessarily distribute the ink by every horizontal movement of the lever. The invention is patented by Mr. John Jones of Clyde, Wayne county, N.Y.

Fig. 4.

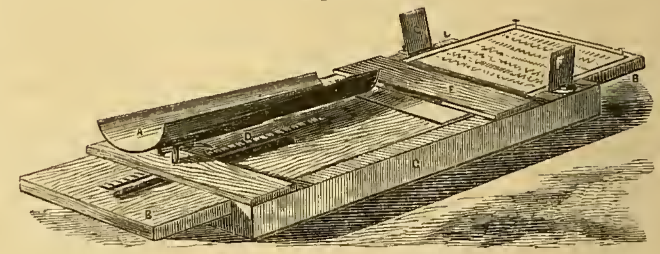


The "copying machine," patented by Mr. Nathan Ames of Langus, Mass., in December of last year, is designed to accomplish a quite dissimilar purpose, and by very different means. In this instrument, the hand of the writer grasps a pen-handle of ordinary size, and moves it in the usual manner to form writing characters, but the motion is communicated to two pens instead of one, and the result is two pages of manuscript precisely alike in every particular. The labour of writing is apparently not increased by this double effect, and the device may be very convenient for many of the useful purposes of correspondence. A shallow box, in which may be deposited a supply of stationery, if desired, is surmounted at its top by a plate of glass to insure a perfectly plane surface. On this the two sheets of paper are clamped by a suitable spring, and the whole, in complete working order, is represented by fig. 4, in which A is the handle, attached by an elastic connection to a light cross-bar, B, in which bar are fixed two pens and a blank point, the office of which latter is to equalize the pressure of the pens upon the paper. A frame of light wires, depending for its support on the fixed points, preserves the parallelism of this bar, so that all the motions performed by one pen are exactly imitated by the other. Two inkstands are provided for supplying the pens with ink whenever necessary.

Fig. 5 is a sketch of a machine, devised by the writer, to facilitate the act of writing with the eyes closed, and may prove of great utility to others suffering from affections of those important and delicate organs. It seems especially adapted to the use of the blind, as, with a suitable fountain pen, there is no occasion for the employment of vision. The machine guides the hand to insure straight lines, moves the paper forward a sufficient space to separate, and indicates correctly where to commence and end each line.

At A is an arm-rest of sheet-iron, mounted upon a vertical pivot, with liberty to revolve or vibrate horizontally. B is a board of suitable dimensions resting upon the thin plank, C, which latter forms the foundation of the machine, and may be laid upon a table or writing-desk. Upon the board, B, the paper is secured in sufficient quantity to last for a long period, and each sheet is removed when filled with writing. The arm moves easily in the rest, the hand being partly supported upon the strip, E, across the top, the farther edge of which may be made to serve as a guide, by allowing the third finger to press lightly against it. To commence a line, the hand is moved over till it touches the guide, F, rising from this side of the machine. The pen is then dropped upon the paper, and it writes until the guide, G, is in contact with the hand upon the opposite side. The pen is then lifted, and the hand moved quietly back upon the slide, E, into its first position. A small pall is attached to the under side of the arm-rest, A, which pall drops into the rack, D, upon the upper surface of the board, B. During the backward movement of the hand in preparing to write another line, this pall comes into play, and moves the board forward one notch, which is just sufficient for a line, and thus the swivelling motion of the arm-rest, A, continues to push the paper forward till the whole has passed under the pen. The sheet being now removed by the left hand, the arm-rest is swung still more to the right, lifting the pall out of the rack, after which the board, B, may be quietly slipped back by the left hand, and the whole is ready for another page of writing.

Fig. 5.



It may increase the interest attaching to this simple device to add, that all the American communications published since May last in this *Journal* have been written by its aid, totally independent of sight.

GREAT WORKS OF ANTIQUITY.

The city of Babylon, according to Herodotus, who had visited it, was a square of fifteen English miles to a side, surrounded by a wall, 75 feet thick, and 300 feet high. Herodotus has been generally found accurate in those statements which were founded upon his own observation, but his accuracy in this case has been much doubted, for the story seems incredible. Think of the enormous labour and expense of erecting a wall 300 feet high, and 60 miles long! Moreover, of what use could it be? It has been calculated that a price of £5625 per yard would in these days have to be paid, and that its total cost would, therefore, be 584 millions. Strabo's more probable account is, that the walls of Babylon were 32 feet thick, and only 75 feet high, with towers at intervals 90 feet high. Diodorus states that the walls of Nineveh were 100 feet in height, and were broad enough at the top to allow three chariots to be driven abreast. Upon the wall stood 1500 towers, each 100 feet above the wall. Xenophon affirms that the wall of Media, as he saw it, was 20 feet thick, and 100 feet high; and that of Mespila was

150 feet in height, with a length of more than 22 miles. The wall of Media extended from the Tigris to one of the canals of the Euphrates, and had a length of 75 miles. It was at this wall that Artaxerxes Mnemon, fearing the attack of Cyrus the younger, subsequently began a ditch, 30 feet wide, and 8 feet deep, which he carried to the Euphrates, 45 miles distant. Xerxes cut a canal across the promontory of Athos, one of three parallel promontories, which extend from the coast of the modern Roumelia into the Ægean Sea. The canal was 2500 yards long, and had a width of 20 feet. This promontory is magnificently terminated by Mount Athos, rising from the sea to the height of 6350 feet, its sides clad with thick forests. The great wall of China is 1200 miles long, from 20 to 25 feet high, and was made wide enough to permit six horses to run abreast. A canal from the Nile to the Red Sea was commenced by Necos, 600 years B.C., but abandoned, after 120,000 persons had perished in the excavations.

Pyramids were erected by the men of olden time in various parts of the world—in Mexico, Hindostan, Assyria, Egypt, and Nubia. The pyramid which covers the largest space of ground is one at Cholula, in Mexico, each side of which is 1440 feet long. Consequently, it covers an area of 47½ acres. Its height at the present day is 177 feet. On the top is a platform, which contains more than 50,000 square feet. A great many pyramids have been discovered in other parts of Mexico, but none so large as this. Amongst the Egyptian pyramids, by much the best known to Europeans, we may mention the great one of Cheops, built, it is supposed, about 900 B.C. Each side of its base is 763⅓ feet in length, and the area of the base is, therefore, about 13⅓ acres, which are about the contents of Lincoln's-inn-fields, between the faces of the houses. The original height was 479 feet, but in its present dilapidated state it is only 456 feet, still 96 feet higher than St. Paul's, London. The surfaces of the four sides contain more than 21 acres, and its solid contents are about 3,400,000 cubic yards. One hundred thousand men were employed for twenty years in building it. The materials were limestone, procured probably in the neighbourhood, and granite, used for the external casing, the blocks of which were brought from a spot 500 miles up the Nile. We shall not stop to mention the various passages and chambers by which this mighty building is curiously perforated, and shall only state that it stands on a platform of living rock, 164 feet above the low-water level of the Nile; and that, whilst part of the rock projects no less than 80 feet into the body of it, a well has been found, bored through the rock to the level of the river. Previously to the construction of this pyramid, a causeway for the conveyance of stone was made, of the length of 3000 feet, 60 feet in breadth, and at the greatest elevation 48 feet high. The stones were polished, and covered with sculptures. Herodotus regarded this causeway as a work quite as wonderful as that of the pyramid itself. It is singular that no traces of this causeway, or of the granitic coating of the pyramid, can now be found. The neighbouring pyramid of Cephren was a little less than this, having a height of 456 feet, and a base with sides of the length of 684 feet. These pyramids, usually termed, along with others of smaller dimensions, the pyramids of Geezeh, are near Cairo. At Sakkarah, nine miles south of the Geezeh pyramids, are more pyramids, one of which has a height of 339 feet, and a base with sides of 656 feet. At Dashour, near Cairo, are other pyramids, the largest of which has a height of 343 feet, and a base with sides of 700 feet.

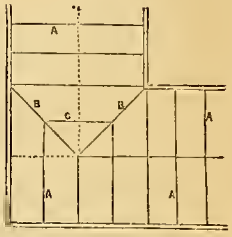
There seems no sound reason for supposing that these vast edifices were built for any other than the paltry purpose of serving as tombs, or transmitting the names of their builders to a regardless posterity. In the heart of one of the largest was found a sarcophagus, containing bones—at least of a king, the reader will suppose—no, only of an ox.

If we had designed to speak of the undertakings of later times, we should have described the mausoleum of that last Indian queen, whose husband expended more than three millions of our money, and employed 20,000 men for twenty-two years, in erecting what is called the Taj Mahal. But we must now pause, first quoting a sentence or two from Mr. Grote, who, in his History of Greece, says—"The human mind is, in every stage of its progress, and most of all in its rude and unreflecting period, strongly impressed by visible and tangible magnitude, and awe-struck by the evidences of great power. To this feeling for what exceeded the demands of practical convenience and security, the wonders both in Egypt and Assyria chiefly appealed. The execution of such colossal works demonstrates habits of regular industry, a concentrated population under one government, and, above all, an implicit submission to the regal and priestly sway. The acquisition of habits of regular industry, so foreign to the natural temper of man, was brought about in Egypt and Assyria, in China and Hindostan, before it had acquired any footing in Europe; but it was purchased either by prostrate obedience to a despotic rule, or by imprisonment within the chain of a consecrated institution of caste."

IRON ROOF IN THE UNITED STATES GOVERNMENT NAVY YARD, BROOKLYN.

The mechanical engineer may, perhaps, gather some hints from the details which we now give of the large iron roof, lately erected for the Government of the United States, over the smithy in the navy yard at Brooklyn, New York. Our fig. 1, annexed, shows part of the plan of the building; namely, one end, with the returning of the roof at the corner, and its continuation on the wing, all being on the same level. The two buildings are 60 feet wide outside the walls. The main building is 300 feet long, and the wing, exclusive of the width of the first building, is 135 feet 4 inches long.

Fig. 1.



This figure also gives a view of the rafters, or principals, A, which are generally 12 feet from centre to centre. On account of the hip, the principals are here placed at 12 feet from centre to centre. The hip-rafter is triangular, the three tie-rods, B, meeting on a ring in the centre, as at fig. 3. At C is a small rafter, 30 feet span, resting on the long trusses of the hip-rafter. Fig. 2, which is a partial elevation of the rafters, shows that there are four purlins on each side of the roof, made of T iron, 2 inches by 2 inches, for the support of the sheet-iron covering at D. On account of the great distance between the principals, these purlins are themselves trussed with round rods. The upper one of these purlins also carries the ventilator, the uprights of which rest on cast-iron brackets, bolted to the T iron.

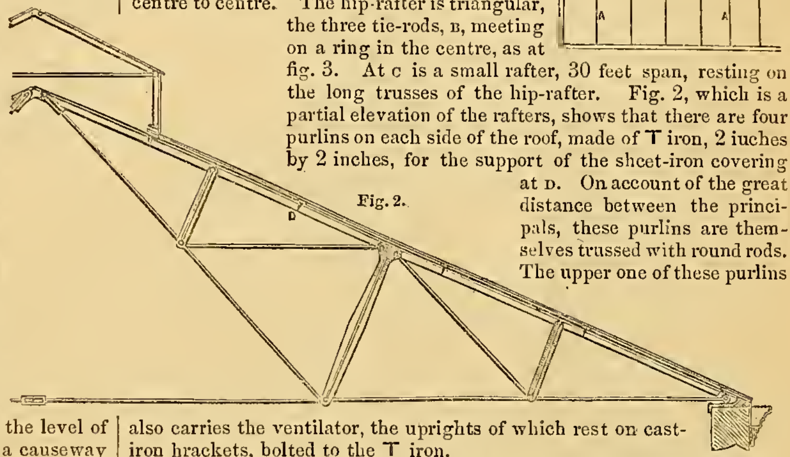
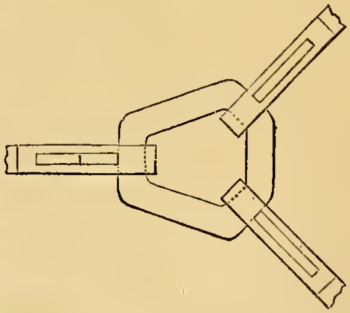


Fig. 2.

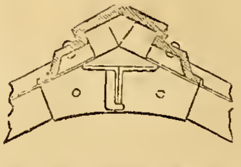
The ventilator is 10 feet wide and 3 feet high, extending along the entire length of the buildings. A ridge-pole of flat iron unites the main rafters at the centre; but the ridge-pole of the ventilator, on which the sheet-iron rests, is made of 1½ inch by 1½ inch angle-iron bars, as shown in fig. 4.

Fig. 3.



At the foot of the rafters, the covering and gutter are both riveted to a purlin of 1¾ inch by 1¾ inch angle-iron, riveted to the rafters, and supported along its whole length by the wall, which is built up under the roof. The rafters are made of T iron, 3 inches by 3½ inches deep, and trussed. The struts, shoes, and centre pieces, are all of cast-iron. The triangular hip-rafter is made of heavier iron, 3 inches by 4 inches, by half-inch T iron. The part, A, is trussed just like the other rafters, every part, however, being of increased strength, on account of the greater surface of covering which it has to carry.

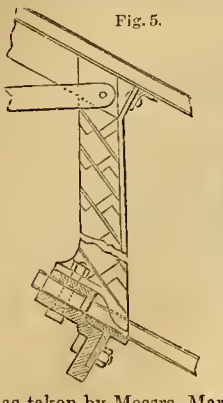
Fig. 4.



Corrugated galvanised iron, No. 22 wire guage, is used for the covering. It rests on the purlins, and is held down by little screw bolts, bent so as to take hold beneath the T iron purlins.

The ventilator uprights, of cast-iron, are three feet apart, each alternate pair being tied across the roof by a tie-rod, whilst longitudinally they are riveted to a range of 1¼ inch by $1\frac{1}{4}$ inch angle-iron, to which the covering is also bolted down. These details are made out pretty clearly in figs. 4 and 5.

Fig. 5.



The slats of the ventilator are plain hoop-iron, one-eighth inch thick, by 3 inches wide. The cast-iron struts for the rafter trusses, as also those for the purlins, are of cruciform section.

The roof has a rise of 15 feet from the centre of the tie-rod, this being the usual pitch of government buildings. The only materials used in its construction are wrought, cast, and sheet iron. Of wrought-iron, there are worked up in it 82,617 pounds; and of cast-iron, 22,700 pounds. Then, making the necessary deduction for the iron used in the ventilator, this amount gives us but little over three pounds per square foot, as the weight of the frame proper of the roof.

The contract for the execution of the work was taken by Messrs. Marshall, Lefferts, & Brothers, of New York; and it was designed and put up by Messrs. Passavant, Archer, & Co., of the same city.

COUPLING GEAR FOR RAILWAY CARRIAGES.

By Messrs. Taylor & Cranstoun, *Morayshire Railway, Elgin.*

(*Illustrated by Plate* 170.)

Travellers by railway must have frequently observed—with some annoyance at the delay thus caused—the process of coupling and uncoupling the carriages; and will, doubtless, have remarked the risk of accident incurred by the necessity of the attendants passing between the carriages to perform the operation. The improved coupling gear introduced by Messrs. Taylor & Cranstoun, is especially designed to obviate all such accidents, by doing away with the necessity of having to pass between the carriages or wagons, when coupling or uncoupling them; whilst, at the same time, such operations may be accomplished by means of this gear with much greater facility and speed than by the existing systems.

Each carriage or wagon, in addition to draw-hooks, has attached to it three parallel-jointed engaging chain-links, freely hinged, so as to be capable of being raised or lowered at pleasure. These links are made with a central back stop-joint, in such manner, that whilst they will act with all necessary flexibility when drawing or being shifted in certain directions, yet, when lifted by the elevating lever, they will rise in a rigid condition, as if solid. Such draw-links may either be disposed in sets of three at each end of the carriage or wagon, or they may be at one end only, with corresponding draw-hooks at the opposite end of the carriage or wagon framing. A transverse coupling or elevating shaft is disposed in bearings beneath each set of links—this shaft having upon it a lever frame-piece, with stud projections thereon, for the purpose of giving the lift to the links. Each end of the shaft carries a hand lever conveniently disposed for the hand of the attendant, so that when passing along the train he can quickly lift or lower the links, holding pins being provided for setting the levers at the required point.

When the wagons are to be coupled, they are placed together in the usual manner; the attendant then passes along either side of the train, and removes the holding-pin (which supports the links sufficiently high to clear the three corresponding hooks on the next wagon); the links then drop, and the necessary engagement is thus instantly effected. When the wagons are to be uncoupled, the attendant lifts the links clear off the hooks by simply pressing down the hand-lever, and either allows the links to drop to a vertical position when the wagon is removed, or, by inserting the holding-pin, the links are fixed in a position for coupling when the wagons are brought together, which can instantly be effected by the removal of the holding-pin, as already described. The action of uncoupling, thus places the links in position for coupling whenever the wagons are brought together.

The carriages are coupled or uncoupled in the same manner as the wagons, with the exception that the centre or draw-link requires to be tightened up after the carriages are coupled, to bring them closely together, and slackened off sufficiently when they are to be uncoupled. To effect this, a transverse hand-wheel shaft is fitted upon the carriage frame; the centre of this shaft having upon it a worm gearing with a worm-wheel set on a longitudinal nut-link of the draw-hook spindle. Hence, by turning one or other of the hand-wheels, the draw-link is tightened or slackened as required. This gearing may be modified in various ways; for instance, the worm-wheel may itself be made to answer as the tightening nut.

The various details of the improved arrangement will be at once understood on reference to our plate, fig. 1 of which is a side elevation of one end of a railway carriage, with the coupling gear fitted to it, the framing being represented partially in section, the better to exhibit the internal parts. Fig. 2 on the plate is a side elevation of the end of a wagon, showing the simpler form of gear designed for this class of rolling stock; and fig. 3 is a combined plan of the carriage framing and coupling details, corresponding to figs. 1 and 2. The coupling of the carriage, A, with the adjoining carriage, the end of which is represented at B, is effected by means of three engaging links, C, D, E. Each of these links is composed of two horse-shoe pieces, connected together by short joint links, F, and by pins passed through the links, F, and through eyes formed on the ends of the horse-shoe pieces. The outside engaging links, C, E, are connected to the framing, G, of the carriage, A, by being passed through eyes in staple links, H, bolted to the frame. The central link, D, is similarly passed through an eye in the end of a draw-link, I, which passes through the frame to the tightening mechanism behind. Immediately beneath the links, G and I, is a horizontal shaft, J, carried transversely in bearings bolted to the carriage framing. This shaft, J, has lever handles, K, fixed upon its extreme ends, outside the carriage framing, and in a convenient position for the attendant to turn the shaft, J, by means of them. This shaft has fixed upon it, just outside the links, C and E, two levers, L, which carry a parallel rod, M, at their extremities, in such a position that when the shaft, J, is turned, the rod, M, elevates the engaging links, C, D, E. Guide pieces, N, are fixed upon the rod, M, and entering within the links, C, D, E, prevent them from swinging to either side whilst being lifted. The links are prevented from being thrown up too high by pins, O, passed through the links, G and I, in suitable positions for that purpose. The eyes of the horse-shoe portions of the engaging links, C, D, E, are formed with angular shoulders, which prevent the links from folding or doubling down when lifted, whilst, at the same time, enough play is allowed for the angling of the links, to suit the slight variations in the distance between the carriages. The draw-link, I, as already mentioned, projects through the frame, H, and has a screw-thread formed upon it at P, to work in a nut, Q, formed externally as a worm wheel, into the teeth of which gears a worm upon a horizontal shaft, R, passing transversely across the carriage, and through bearings in the side frame timbers, S. The shaft, R, has hand wheels, T, fixed upon its overhanging extremities outside the carriage framing, and in a convenient position for the attendant, who, by turning the hand wheel, can slacken or tighten up the link, I. The worm wheel nut, Q, is held on one side by a cross piece, U, fixed upon a pair of stays, V, bolted to the transverse end frame piece, H, and to an inner transverse frame piece, W; through an eye in which last, the link spindle, I, is also passed. A helical spring, X, is placed on the link spindle between the frame piece, H, and the worm wheel nut, Q, and allows the draw-link to yield to jerks or extra strain. The other end of the carriage may either carry plain connecting hooks, as at Y, or both ends may be fitted up with the engaging links, the staple links from which the engaging links are suspended being in that case all formed with hooks. The coupling gear represented in fig. 2, between the wagon ends, *a* and *b*, is the same as that between the carriage ends, A and B, fig. 1, except as regards the central draw-hook, *i*, which in the wagon is simply fixed to the frame piece, *h*, like the staple links, *g*, instead of being provided with the tightening mechanism, as employed with the carriage coupling.

In fig. 1, and in the corresponding portion of fig. 3, the carriages are represented as coupled together, and with the central link, D, tightened up; whilst in fig. 2, and in other portions of fig. 3, corresponding to it, the links are represented as raised by means of the handle, *k*, the shaft, *j*, and the rod, *m*, into the position in which they are clear of the points of the hooks, Y, of the adjoining wagon, *b*, which can accordingly be now removed. After removing the wagon, *b*, the links, *c*, *d*, *e*, may either be allowed to drop into a vertical position, or a pin, *z*, may be placed across the lever handle, *k*, so as to keep the links in their elevated position until another wagon is brought up to them, when they may be dropped upon the hooks of such wagon, by merely releasing the lever, *k*; thus coupling the wagons.

This improved coupling and uncoupling gear has been tried on the Morayshire Railway, where it has given complete satisfaction, being both complete and speedy in its action. It is a very obvious improvement upon a detail of railway plant, which has been too long and too seriously neglected.

THE SOCIETY OF ARTS' EXHIBITION.

There is one metropolitan exhibition to which we give a yearly welcome with more than common solicitude, and that is the collection of the results of the latest shoots of invention, made by the hale old Society of

Arts. Coming at short intervals, and stretching over a wide expanse of novel conceptions, these gatherings deserve to be looked to as affording some substantial indication of the realities of industrial progress. They are the stock-takers of improvement, determining, with matter-of-fact accuracy, the state of the balance existing between our original inventive capital, and whatever we have been industrious enough to call into being since our last account. Let us then see what the seventh exhibition of the past month says as to our recent efforts.

The catalogue, which has this year gone into the octavo form, reaches fifty-two pages, and informs us that the collection numbers three hundred and twelve articles. This is the amount of separate heads; but as there are a great may instances of sub-heads, not incorporated in this current list, the number of things actually exhibited is somewhat greater. The sectional heads have been laid out with some departure from the rule of the last collection. They are,—

1. *Motive Machines, including Railway Mechanism.*
2. *Manufacturing Machines and Tools.*
3. *Building Contrivances and Materials, and Hardware.*
4. *Naval and Military Mechanism and Philosophical Instruments.*
5. *Agricultural Implements and Saddlery.*
6. *Miscellaneous, including articles for personal and domestic use.*

Foremost in this bill of fare, are a set of about twenty contrivances for the prevention of smoke, exhibiting nearly every variety which that wide and sorely-vexed subject is capable of presenting. We confess our perplexity in this array of schemes, and pass on. Railway mechanism and motive power engines are pretty fully represented in this section—so are valves and stop-cocks. In Class 2 we have Lord Berriedale's ingenious loom for weaving tape and narrow goods, noticed by us in our Part 64, vol. 6, as a clever plan for avoiding the stoppage of the range of shuttles on the fracture of a thread. Messrs. Sibley's "Circular Plate-Cutting Machine" is also a prominent novelty in this division.

Class 3 is rich in building materials, drainage pipes, and locks. The hardware, also incorporated here, contains an ingenious uncorking and decanting stand for bottles, by Mr. T. G. Shaw; the "Furbator," or knife-cleaner, by Mr. Hilliard of Glasgow; and many other conveniences for house use.

Class 4 is an important division, inasmuch as it tells us what has been lately doing in ship fittings and life-boat gearing. Captain Norton's gunnery improvements, noticed from time to time in these pages, are also here gathered together for serviceable show.

Agriculture proper, is but sparingly represented in Class 5, owing, we presume, to the devotion of the implement makers to the great periodical exhibitions of this exclusive class of mechanical contrivance.

Class 6, the resort of unclassable articles, contains a few ingenuities which we must notice, together with the bulk of the more important contents, next month, when we can both figure and describe them in detail.

MECHANIC'S LIBRARY.

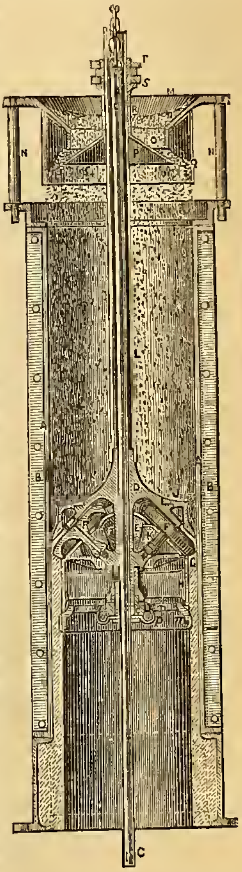
Agricultural Chemistry, Principles of, 12mo., 3s. 6d. Liebig.
Architecture, Popular Account of Styles of, 8vo., 1s. 6d. Tarbuck.
Differential and Integral Calculus, Treatise on, 9s. Carmichael.
Electricity, Experimental Researches in, vol. 3, 8vo., 18s. Dr. Faraday.
Elementary Geology, Manual of, fifth edition, 8vo., 14s. Sir C. Lyell.
Elementary Mathematics, Part I., Algebra, 12mo., 2s. 6d., cloth. Elliot.
Geology: Its Facts and its Fictions, fcp. 8vo., 5s., cloth. W. E. Taylor.
Harmonic Law of Nature applied to Architectural Design, 2s. 6d. D. R. Hay.
Metallum Martis, 4to., 7s. 6d., cloth. Dudley.
Painting, Hand-Book of, Italian Schools, third edition, 2 vols, 30s. Kugler.
Photographic Chemistry, Manual of, 6s. 6d. T. F. Hardwick.
Physical Geography of the Sea, royal 8vo., 8s. 6d. M. F. Maury.
War Implements, Dictionary of, 1s. 6d., boards. Piper.
Warming Buildings by Hot Water, third edition, 10s. 6d. C. Hood.

RECENT PATENTS.

MOULDING MACHINE FOR CAST-IRON PIPES.

T. Sheriff, *Glasgow.—Patent dated October* 2, 1854.

This very simple and ingenious mould-making machine is represented in vertical section in the accompanying engraving.



The mould-box, A, is a cylindrical iron casting, formed in two halves, and bolted together by the longitudinal flanges, B, so that it can be separated for the purpose of removing the pipe cast in the mould formed in it. A square shaft, C, passes up vertically through the axis or longitudinal centre line of the mould-box, being driven from below in any convenient manner, and upon this shaft is passed a lantern-piece, D. This lantern is of the shape of an inverted cup, and is formed with a tubular boss, E, which fits upon the shaft, C, in such a manner that the lantern turns with the shaft, whilst it is at the same time free to traverse longitudinally or vertically upon it. Beneath or within the lantern, D, are four conical rollers, F, which run upon spindles fixed in radiating and inclined positions in the lantern, and lying at equal distances apart round the boss, E. The positions of the rollers, F, are such, that the lowermost points of their peripheries, for the time being, are also the outermost points, the rollers being at these points just clear of the internal surface of the mould-box, A. The peripheries of the rollers correspond in width to the thickness to be given to the sand or loam portion of the mould, as at G. The precise dimensions and shape of the internal surface of the mould, as formed by means of the present apparatus, is determined by a short cylindrical pattern-piece made of cast-iron or otherwise, and connected by arms to a central boss which is carried loosely upon, and moves up with, the boss, E, of the lantern. The upper outer edge of the pattern-piece, H, coincides with the inner and lowermost points of the rollers, F. The top of the lantern-piece, D, is formed with turned-up flanges, J, arranged so as to form channels for guiding the sand or loam down in front of the rollers, F. The sand or loam is fed in from above, and finds its way down to the rollers, F. The shaft, C, being made to revolve, it carries round the lantern, D, and the rollers, F, and these rollers roll or press down the sand or loam between the pattern-piece, H, and the internal surface of the mould-box, and so form the mould. As the operation continues, the sand or loam gradually increases in depth beneath the rollers, and these gradually rise, carrying up with them the lantern-piece, D, and the pattern-piece, H; and the sand or loam being supplied continuously, this action goes on until the mould is completed throughout its entire length or height. The apparatus will, of course, form the mould of uniform section throughout, and faucets or flanges, if required, must necessarily be made by a separate operation. The sand is almost entirely prevented from falling through the central openings in the pattern-piece, H, by conical shield pieces, K, which are connected to the lantern boss, E, in such a manner as to fill up the spaces between and within the rollers, F. But if any particles of sand or loam should find their way into the interior of the lantern, they will not remain, and so choke up the space, but will fall freely away through the pattern-piece, H. The sand or loam is prevented from getting into the boss, E, of the lantern-piece by a tube, L, fitted to the top of the lantern-piece, and rising up with it. The sand or loam may be fed in the ordinary manner; it is preferred, however, to employ the apparatus for regulating the feed represented in the figure. This apparatus consists of a hopper, M, supported above the mouth of the mould-box, A, by the rods, N. A circular opening, O, concentric with the mould-box, is formed in the bottom of the hopper, and to this opening is applied a conical valve-piece, P, by raising or lowering which, the opening, O, may be diminished or increased, and the feed of the sand or loam thereby regulated at pleasure. The sand or loam passes out of the hopper by the annular space between the cone, P, and the bottom of the hopper, and it is prevented from being scattered outside the mould-box by the cylindrical curtain, Q. The sand or loam thus falls down the mould-box to the moulding rollers in a continuous uniform stream, the hopper, M, being kept constantly supplied. The conical valve-piece, P, is formed with a tubular boss, R, fitting loosely upon the tube, L, and the upper portion of this boss is formed with collars to retain two rings, S, T, by means of which, the conical valve-piece, P, is raised or lowered for regulating the feed of the sand or loam. The lower ring, S, is formed with radial arms, upon which are sliding blocks formed with inclined under sides. These blocks lie upon inclined flanges cast upon the top of the hopper, M, and thereby support the boss, R, and conical valve-piece, P. The blocks are connected by links to the ring, T, which has arms or hand-levers fixed to it, so that, by turning it, the links may be angled so as to draw in or push out the blocks. By drawing in these blocks, they will obviously be made to rise up the inclined flanges, these flanges being inclined upwards towards the centre of the hopper, and this action will lift up the conical valve-piece, P, and close the feed opening, O, more or less; whilst the reverse movement will, of course, have the effect of opening this feed aperture. The hardness of the sand or loam at G, forming the mould, depends on the friction of the pattern-piece, H, against the internal surface of the mould, which friction has the effect of retarding the upward motion of the lantern and rollers. The weight of the lantern and rollers, if unbalanced, also aids the downward pressure on the mould as it is being formed, and this downward pressure may obviously be modified by adapting balance weights to the lantern to counteract the action of the weight. A contrivance is represented in the figure for producing fillet recesses in the mould, as the formation of the mould goes on. The fillet is produced by fillet pieces, *m*, which revolve with the shaft, C, and press in the sand of the mould where the fillet is to be made. The fillet-formers or shapers, *m*, which may be two or more in number, are carried upon the ends of arms, *n*, radiating from the shaft, C, and working in radial slots in the boss, O, upon the shaft. The inner ends of the arms, *n*, enter longitudinal grooves in the shaft, C, and in these grooves, raised portions are formed at intervals corresponding to the positions at which the fillets are to be formed in the mould, or the raised portions may be external to the shaft, and grooves may be formed in the boss, E, for them to pass through. When the arms, *n*, come opposite to the raised portions on the shaft, the arms are forced outwards, and cause the fillet-formers, *m*, to enter slightly into the sides of the mould, when the revolution of the shaft, as it were, turns out the fillets. When the arms are past the raised portions of the shaft, they are drawn inwards by springs, *p*, and the fillet-formers, *m*, are made to recede within the inner surface of the mould, until the point is reached at which another fillet is to be formed. According to another modification of the apparatus, a screw blade or screw blades may be substituted for the pulleys or rollers; such screw turning with the central shaft and rising upon it, the other details of the apparatus remaining the same. The carriage for carrying the moulding-box may be made in various ways, but it is preferred to suspend the boxes from the carriage, the one-half of the box being a dead fixture to the carriage by the vertical flange, the other half of the box being fixed by pins and bolts to its neighbour. These carriages have each four pairs of wheels, two pairs of these being fitted with eccentrics, so that, when required to be moved at a right angle, the eccentrics are moved round on their axles to the opposite side. By these means the other two pairs are raised off the rail, to allow the carriage to move on the rails placed at right angles.

HORSE MUZZLES.

T. Clowes, *Beverley.—Patent dated September* 9, 1854.

Mr. Clowes' inventive efforts have been directed to the removal of an unpleasant habit which some horses have of biting or sucking their crib or manger. This he professes to effect by means of a muzzle, which is represented in elevation in fig. 1 of our engravings, and in vertical section in fig. 2.

The body of the muzzle, A, is composed of leather, or any other suitable material, and is formed with apertures in it, in order not to impede respiration. A light metal frame, B, is fitted into the lower portion of the muzzle, and across this frame is fixed, longitudinally, the perforated bar, C. Immediately beneath this fixed bar is placed a second bar, D, which is moveable in a vertical direction, and is fitted with a number of prickers, or sharp points, E. This moveable bar is connected to the fixed bar by the two screws, F, which allow of a slight vertical play between the two bars. Two blade springs, G, secured to the under side of the fixed bar, are for the purpose of pushing down the bar, D, and shielding the prickers in the perforations of the fixed bar, when the moveable bar is not acted upon by pressure from below. Two small projections, H, formed on the frame, B, and projecting beyond the bar, D, serve to prevent this bar from being acted upon when the horse is eating off a flat or hollow surface of a greater width than the distance between the projections. But if the animal attempts to bite, or suck his crib, or presses his mouth downwards upon any hard thing, which is not wider than the distances between the projections, H, the prickers will be forced upwards through the perforations in the bar, C; and as these pricking points will thereby be brought into contact with the animal's mouth, the objectionable habit will be effectually checked. The muzzle, being open at the bottom, will not prevent the animal from feeding; but, when it is desirable to stop him from feeding, a perforated plate may be inserted into the frame of the muzzle, being fastened therein temporarily by a fixed pin on one side, and a small bolt on the other, so that it can be removed with the greatest facility. Another set of prickers are fitted into the back of the muzzle, and act upon the under jaw of the animal when attempting to suck his crib. The sharp points are fitted to the fixed curved bar, L, which is secured to the inside of the muzzle, and they are shielded or protected by the slotted or perforated bar, M, which is connected to the bar, L, by screws at N, working in slots in the bar, M, thus allowing it to be pressed downwards by the under jaw of the horse when sucking its crib, and thereby causing the prickers to protrude.

Fig. 1.

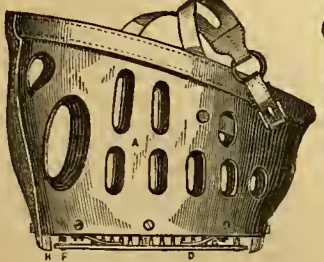
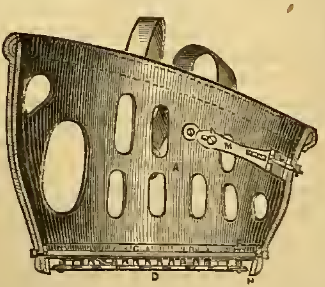


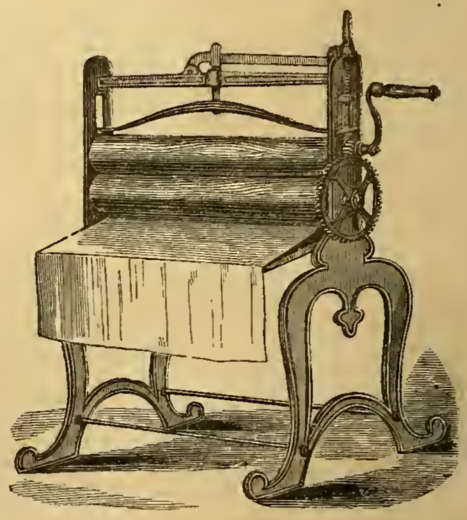
Fig. 2.



CLOTHES MANGLES.

E. O. Tindall, *Scorborough.—Patent dated October* 5, 1854.

This patent comprehends various improvements upon Mr. Tindall's well-known "vertical" and "imperial" mangles and wringing machines, and the accompanying engraving is a perspective elevation of a mangle as constructed according to the improved system. Two mangling rollers are employed in this machine, instead of three, as ordinarily fitted to machines of this class. These two rollers are carried in bushes or bearings fitted into a pair of slotted cast-iron side standards, which are tied together by a cast-iron crosshead above, and a couple of wrought-iron rods below. The upper roller is pressed downwards by means of bearing pieces acting upon its spindles, and capable of traversing vertically in slots in the side standards. These bearing pieces project above the level of the roller, and are acted upon by, or sustain the points of, a compound blade spring. This spring is held by means of a pin acting upon its centre, and passing through a perforation in the crosshead above. The upper end of the pin is formed with a slot, through which passes a lever jointed to the crosshead, and having a handle fixed upon its free extremity. When the spring pressure is to be put upon the rollers, the lever is brought down, and its outer end is entered in between a pair of snugs, cast upon the upper end of the side standard, being secured in this position by a pin entered across the top of i through the snugs. On taking out this pin, the spring rises, and the rollers are relieved from its pressure. The rollers are driven by means of a spur-wheel fixed on the spindle of the lower roller, and in gear with a pinion, upon the spindle of which a winch-handle is fixed for working the machine. The driving pinion is carried in a small moveable box, fixed to the lower end of a rod, which passes up through guide brackets, fixed to the side standard. A helical spring is passed upon the last-mentioned rod above the upper bracket, and acts between this bracket and a collar or button on the top of the rod, so as to have a tendency to lift the rod up, and thereby raise the pinion out of gear with the spur-wheel. The top of the sliding rod is immediately under the end of the

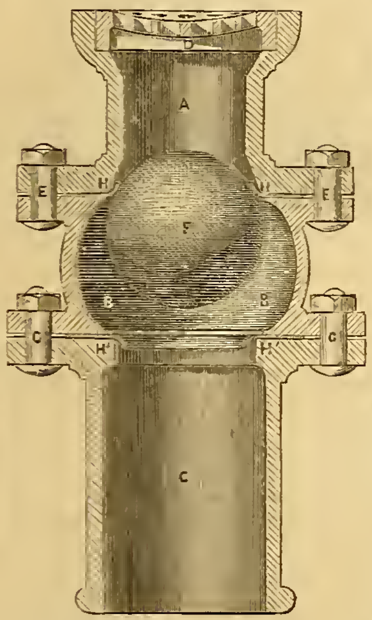


spring lever, and when this lever is brought down, to put the spring pressure upon the rollers, it at the same time depresses the sliding rod, and puts the pinion into gear with the spur-wheel. Then, when the clothes are sufficiently mangled, the lever is released, and the sliding rod is at the same time raised by the action of the small helical spring, so as to lift the pinion out of gear with the spur-wheel, and thus prevent the handle from being turned by the rotation of the rollers in drawing out the mangled clothes. A mangling cloth is fixed to the lower roller, and, when unwound, this cloth lies upon a slightly inclined board, hooked or fixed to the framing, and the clothes to be mangled are introduced between the folds of the cloth as it is wound up by the rotation of the roller.

SEWER TRAP AND DRAINAGE VALVES.

R. Rawlinson, C.E., *Westminster.—Patent dated September* 14, 1854.

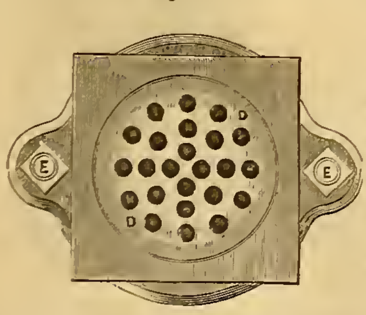
Fig. 1.



Mr. Rawlinson's valve is more especially intended for drainage and sewerage works, and is particularly suitable for localities which are subject to the effects of tidal or flood waters. Fig. 1 of our engravings is a vertical section of the valve, as applied immediately below the grating of a sewer, and fig. 2 is a plan corresponding.

The shell of the apparatus is made in three parts, A, B, and C; the upper portion, A, is in connection with the surface to be drained, and is fitted with a perforated or other grating, D. It is cast with two lugs at E, and is secured by bolts to corresponding lugs on the upper portion of the spherical valve chest, B. This case is made with an aperture sufficiently large to admit of the introduction of a buoyant ball valve, F, and when the same has been introduced therein, the valve chest is bolted at G to the pipe, C, which communicates with the drain. Water-tight valve seatings, H, H', are formed at the upper and lower apertures of the spherical valve chest, B, by interposing a ring of vulcanized india-rubber, leather, or any other suitable material, between the junction flanges. When the buoyant ball valve, F, is subjected to pressure from below by the entrance of tidal or flood water into the drains, it floats on the surface of the rising water in the spherical chamber, B, and is pressed against the upper valve seating, H, closing it so as to effectually prevent any water from rising up to the surface and flooding the premises. As the flood or tidal water recedes again, the ball valve gradually falls with it, and finally rests upon the lower valve seating, H', in which position it acts as an effectual stench trap, by closing up the mouth of the drain. This ball does not in any way interfere with the surface drainage, for when a sufficient quantity of water to float the ball has entered the valve chest from above, the escape aperture will be opened by the rising of the ball, and the drainage water will flow off; this action taking place intermittently, or whenever a sufficient quantity of water has accumulated in the valve chest to float the ball. As a small quantity of water will always be left round the ball when in its lower seating, it follows that the joint will be perfectly impervious to the noxious gases in the drain, and, consequently, a most effectual stench trap will be obtained.

Fig. 2.



STEAM-ENGINES AND GOVERNORS.

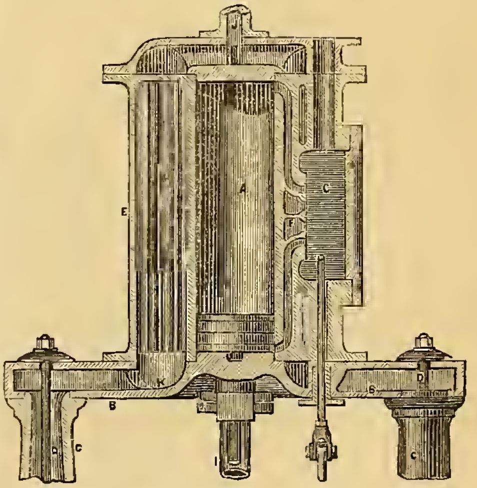
J. W. Hackworth, *Darlington.—Patent dated September* 9, 1854.

This patent comprehends various modifications of the general details of steam-engines, as more especially intended for stationary and marine purposes, with the view of securing proper efficiency of working action.

One detail of these improvements relates to a "Duplex Over-end Crank," to be used instead of the ordinary crank arrangements of steam-engines. This double crank is made by keying, or forging on, the end of the main shaft, a plain crank arm of the usual kind. The opposite end of this crank is formed with an eye to receive a stout crank-pin (answering as the working pin for one steam-cylinder), which is forged in one piece with a second arm, or lighter crank lever. The other end of this secondary arm has forged upon it a second crank-pin for the other steam-cylinder. The stouter pin of the secondary crank arm is fixed into the eye of the first crank, so as to set the two arms at a considerable angle with each other, or at a right angle, as may be desired. The slide-valve for each steam-cylinder of a pair of engines may be worked from a spanner, keyed on the end of the secondary crank-pin; the other end of this spanner being directed back as far as the centre of the shaft, whilst it terminates in a solid pin set true with the axial line of the main shaft, upon which two eccentrics may be placed for working the steam-slides; or, instead of two eccentrics, two eccentrically disposed pins may be used.

The steam-cylinders for actuating this "Duplex Over-end Crank" are disposed, one on each side of the main shaft, opposite to each other, and nearly in the same straight line. The axial lines of the two cylinders must vary sufficiently in the plane of the shaft, to allow for the thickness of the second crank, in addition to one-half of each crank journal. But by cranking the second crank lever, this distance may be diminished.

Fig. 1.



Another portion of the improvements relate to a system of economizing steam power, by means of an arrangement which is represented in vertical section in fig. 1 of our engravings. Here an inverted steam-cylinder, A, supposed to be placed vertically above the shaft which it drives, is supported upon a hollow cast-iron platform, or table, B, the central portion of which is shaped to answer as the bottom cover of the cylinder with the piston-rod stuffing-box cast upon it. The table, B, is carried by four hollow cast-iron pillars, C, being held down by long bolts, D, passing to the base frame below. The steam-cylinder, A, is cast in one piece with, or it may be otherwise attached to, an outer cylinder, E, arranged to enclose an annular space round the cylinder, A. The exhaust port or ports, F, in the valve casing, G, communicate with this annular space, into which the exhaust steam from the steam-cylinder consequently enters. A number of tubes, H, are passed vertically through the space between the two cylinders; and they communicate with spaces above and below the cylinders, and through these tubes the feed-water is made to pass on its way to the boiler, being pumped up from below by the pipes at I, and passing off above by the pipe, J. It follows from this arrangement, that the exhaust steam surrounding the steam-cylinder, A, will prevent loss by radiation of heat therefrom, and will, at the same time, communicate a portion of its heat to the feed-water rising through the tubes, H. The exhaust steam, and any condensed portion of it, finally passes off by the bottom port, K, which communicates with the interior of the hollow table, B, and with the hollow pillars, C, being thus spread over a large extent of metallic condensing surface, and, finally, finding its way to a cistern below. The arrangement just described is obviously most suitable for a vertical steam-cylinder; but the apparatus may also be adapted to steam-cylinders arranged in other positions. Thus, with horizontal steam-cylinders, the tubes, H, may be bent round across the steam-cylinder, but it is preferred in all cases to have these tubes as nearly vertical as possible.

The patent also covers a new form of governor, which is represented in vertical section in figs. 2 and 3, and consists of a three-branched vessel or pipe, A, carried upon a vertical spindle, B, supported and driven in the manner usually employed with ordinary ball or pendulum governors. One, C, of the three branches of the vessel, A, rises up centrally and vertically, whilst the two other branches, D, run out, upwards and laterally, on opposite sides. The central branch, C, is bored out cylindrically, and inside it works a plunger, or heavy float, E. A rod, F, passes up from the float, E, through a hole in the cover of the pipe, C, and is jointed to the lever, G, which transmits the regulating action of the governor to the throttle valve, H. A quantity of mercury, I, or other suitable fluid, is placed in the vessel, A, which mercury fills the three branches to the same level when the governor is at rest. On the governor being caused to revolve, however, the centrifugal action causes the mercury to run up the lateral branches, D, and to sink to a lower level in the central branch, C. If the governor is driven beyond the proper rate, the mercury will sink so low in the central branch, C, as to allow the float, E, to descend, which movement will act on the throttle-valve connections in such a manner as to partially close the valve, and diminish the supply of steam to the engine. Contrariwise, when the governor revolves at too low a rate, the mercury will sink in the lateral branches, D, and rise correspondingly the central branch, C, lifting the float, E, and thereby causing the throttle-valve to open further, and give an increased supply of steam to the engine, to enable it to recover its rate. The throttle-valve, H, represented as in connection with the improved governor, is also constructed according to one portion of the invention. The valve seating consists of a cylinder, J, fitted into the steam-pipe, K, in such a manner that one end of the pipe communicates with one or both ends of the cylindrical seating, whilst the other end communicates with the circumference of the seating, the steam having to pass through the cylindrical valve seating on its way to the cylinder, this passage being effected through slots in the seating. The spindle, L, of the valve passes through the axis of the seating, and carries a number of radial feathers corresponding to the slots in the valve seating, J, and turned on their circumferential edges to work upon the turned inside surface of the valve seating. The valve is thus balanced as regards the steam pressure, which can in no position have any tendency to shut or open it, or prevent its being shut or opened, by the least possible force applied to its lever.

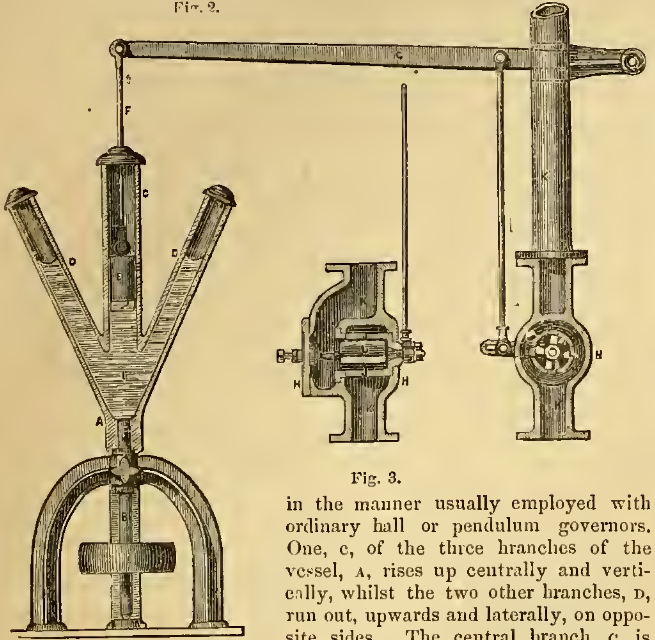


Fig. 2.

Fig. 3.

In addition to the above, Mr. Hackworth also describes two arrangements of reversing gear for mining and similar engines.

PIPES AND PIPE JUNCTIONS.

Michael Scott, *Great George Street, Westminster.—Patent dated May* 30, 1854.

Mr. Scott, who is well known in connection with the water-works department of engineering, has, in the present instance, turned his attention to a means of providing for the longitudinal expansion and contraction of metal pipes. One mode by which this provision is made, according to this invention, consists in forming the flanges of the pipes larger than usual, and in bolting them together near their edges only, so that the annular portion of the flange between the ring of bolts and the body of the pipe may be free to yield, to allow for the longitudinal expansion or contraction of the pipe. Fig. 1 of our engravings is a longitudinal section of a pipe junction, formed according to the improved system. The flanges, A, are made larger than usual, and are slightly hollowed on their adjacent faces, in such a manner as to be in actual contact, as at B, at their outer edges only. The bolts, C, by which the flanges, or lengths of pipe, are held together, are passed through the narrow rims of the flanges at B, where the contact takes place. In the arrangement represented in fig. 1, the flanges are cast upon the pipe lengths; but a different modification is represented in fig. 2, which is also a longitudinal section of a pipe junction. Here the flanges are separate castings, riveted to the pipe lengths. The joint is also modified by the introduction of a ring, A, to keep the two flanges apart towards their central portions, instead of effecting this by making the flanges thicker at their outer edges, where the contact between them takes place.

Fig. 1.

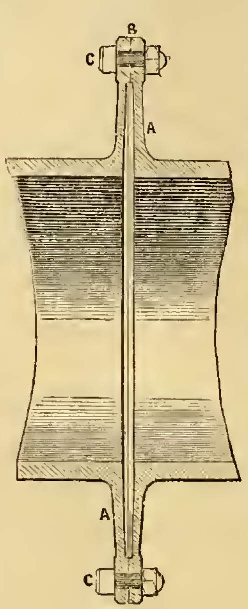


Fig. 2.

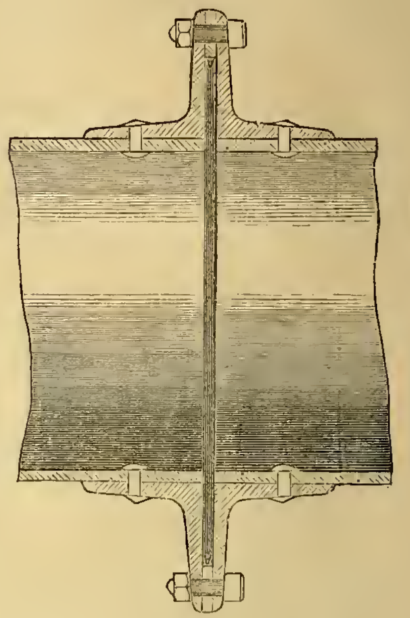
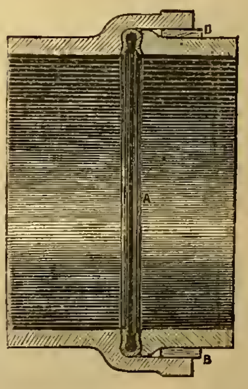


Fig. 3 of the engravings is a longitudinal section of a pipe junction of the spigot and socket description, showing a modification of the improved packing which Mr. Scott employs for rendering the joint tight. This packing admits of the contraction and expansion of the lengths of pipe, without lessening the tightness of the joint.

The packing of the joint is a ring, A, of gutta percha, lead, tin, pewter, or other soft metal or alloy, and resembles an annular pipe, slit open on the side towards the centre, and having its edges slightly turned over. This ring is applied between the end of the spigot and the bottom of the socket, in such a manner that the slit is open to the interior of the pipe; and the pressure of the fluid in the pipe, thus acting on the inside of the hollow ring, tends to open it, and keeps its side pressed against the socket, and against the end of the spigot, notwithstanding that the distance between the contact edges of the two lengths of pipe may vary from the contraction or expansion due to differences in the temperature. Wedges, B, of wood, are inserted in the mouth of the socket, to hold the spigot of the adjacent length of pipe firmly in its place.

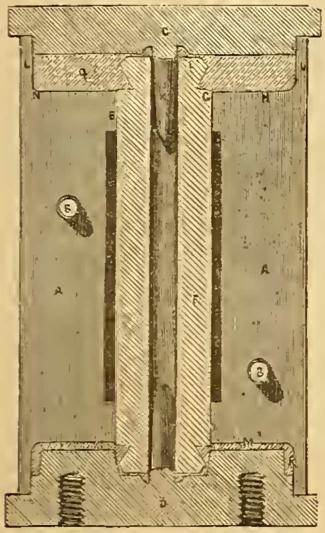
Fig. 3.



BOBBINS.

Robert Renfrew, *Glasgow.—Patent dated September* 27, 1854.

Fig. 1.



Mr. Renfrew's improved bobbins for winding yarn or textile materials are made on what may be termed a compound or composite principle—the essential object of the improvements being the prevention of injury and fracture of the bobbin ends, from the concussions ordinarily arising in the use and wear of the articles. Bobbins of the general class, to which this invention is more particularly applicable, have hitherto been usually made entirely of wood; the barrel or central spindle portion being, in each case, a distinct piece of wood, whilst the end discs or flanges are separately attached. According to the present invention, however, the barrel or central spindle portion of the bobbin is made of wood, metal, or other suitable material, and the end discs or flanges are made of gutta percha, or of a composition wherein gutta percha is an ingredient; or other suitable material or composition possessing papier-maché or pasteboard material may also be used for this purpose. Indeed, any cheap pulpy or mouldable material may be thus adapted. The end discs or flanges, so made, are shaped and attached to the spindle or barrel piece at one and the same operation; and in thus making the bobbins, it is preferred to mould the disc pieces upon the barrel or spindle pieces by means of suitable dies or moulds. The flange parts may, however, be made separately, and fixed upon the barrel or spindle by a subsequent operation. Fig. 1 of our engravings is a longitudinal section of a composite bobbin and its flange mould complete, as it would appear after the completion of the moulding and attaching process.

Fig. 2.

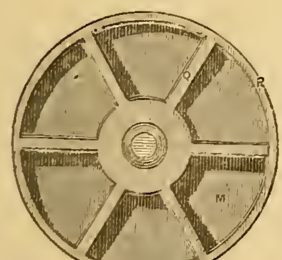


Fig. 3.

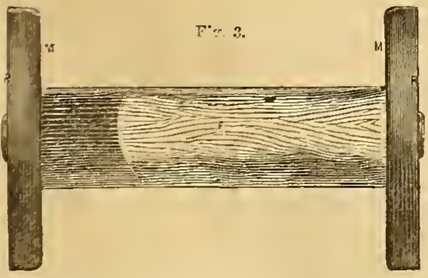


Fig. 2 is an external end-face elevation of one of the moulded gutta percha bobbin flanges, and fig. 3 is an elevation of the composite bobbin, with its two gutta percha flanges attached complete. The mould, which is made large enough to enclose the entire bobbin, is of tin, or other suitable metal. It is composed of two main body pieces, A, furnished with steady pins, and corresponding holes, B, to insure accurate fitting of the two halves, along their line of longitudinal contact, and two end flanges, C, D. When used, the apparatus is placed horizontally, or it may be set vertically, as represented in fig. 1, and the two opposite end flanges are then moulded on, either in succession, or simultaneously. The body portion of the mould, A, is formed with a rough hole directly through it, in the line of junction of the two pieces, shoulders being left at the two ends, as at E, and truly bored out, to fit the barrel piece, F, of the bobbin, and retain it in its due central position. The barrel piece of the bobbin is then inserted in the two retaining shoulders, E, the square shoulders, O, of the barrel being set so as to be accurately flush with the square turned-out face, H, of the recessed end of the mould. The extreme ends of the barrel piece are turned with a dovetail, as at I, to afford a good hold for the plastic material to be moulded thereon.

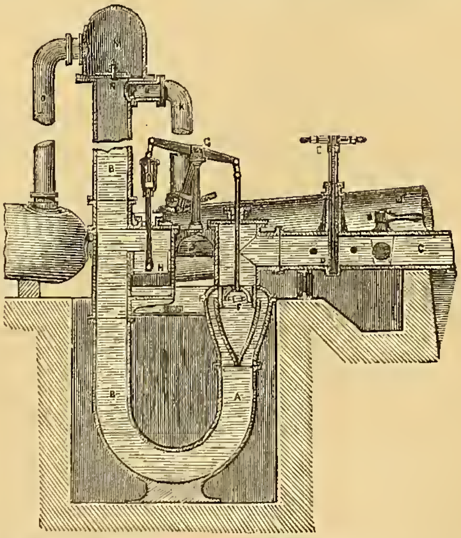
In this condition of the parts, the gutta percha, or whatever other plastic material or composition is to be used in the formation of the end flanges, is supplied in a heated, and consequently plastic, state to the end recess, J, formed by the two halves, A, of the body portion of the mould, which halves are now placed together. The end flange, or cap, C, of the mould is now brought forcibly down upon the soft mass of deposited material, the central pin, K, which is fast in the piece, C, being entered into the open end of the bobbin barrel, F, as a guide. The pressure of the moulding cap, C, which is further guided by entering the end of the recess, J, of the mould, as at L, thus moulds the gutta percha to the finished shape of the bobbin end flange, as at M, and at the same time firmly binds it on to the dovetail of the bobbin barrel end. The action of both the end moulding surfaces is obviously the same. The face, H, at the bottom of the mould's end recess, is plain and flat; its junction with the annular flange part being rounded off, as at N. This surface moulds the inner surface of the bobbin flange. The inner surface of the end piece, C, of the mould, is formed with a central recess to produce the central boss of the flange; and from this part six radial grooves are cut through to the periphery of the moulding face, to mould corresponding arms or flanges, Q, upon the outer face of the bobbin flanges.

In the view, fig. 1, the upper part of the mould is represented in section, so as to cut longitudinally through two of these radial flanges; in the lower part, the section is between the flanges. When the ends, C, D, of the mould are removed, the two halves, A, are separated, and the finished bobbin is released. The flanges of bobbins so made are extremely light and tough. The disc portions of them are strengthed and stiffened by the radial ribs or arms, Q, which form junctions between the bosses and the external annular flange, R. Various sectional forms of flanges may be adopted, but the one represented is simple in detail, and it possesses great strength.

COMPRESSING AND RAREFYING AIR.

J. H. Johnson, *London and Glasgow:* (Germain Sommeiller, *Turin.*) *Patent dated October* 7, 1854.

Mr. Sommeiller's invention relates to apparatus for compressing air, and for producing a vacuum by the direct action of water descending from an elevation, without the intervention of the ordinary motive power engines, such as water-wheels or turbines, and forcing pumping apparatus.

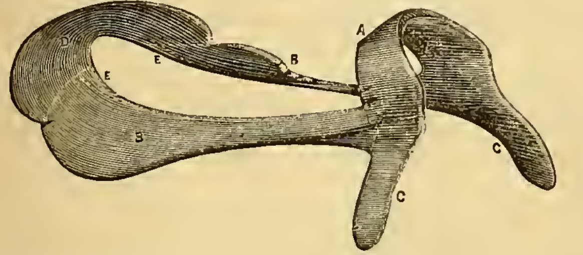


A modification of the apparatus is represented in vertical section in the accompanying engraving. It consists principally of an inverted siphon pipe, A, B, the leg, B, of which is of considerable length, but is represented as with a portion broken away to bring the figure within reasonable limits. The short leg, A, of the siphon pipe communicates with a supply pipe, C, fitted with a sluice valve, D, which is worked by means of a screw spindle and hand wheel, E. A second valve, F, is arranged to work in the leg, A, of the siphon pipe, for the purpose of cutting off the supply at intervals. This valve, F, is worked by a rod passing up through a stuffing-box to a lever, G, the other end of which is jointed to the rod of a third valve, H, working in an exit chamber, communicating with the pipe, B, at about the level of the supply pipe, C. When the valve is open, the water in the siphon pipe passes off through the valve, H, and by a discharge pipe not shown in the engraving. The exhaust vessel in which the vacuum is to be formed is a boiler-like structure, J, which communicates by a pipe, K, with a valve chamber, L, at the upper end of the pipe, B. The valve in the chamber, L, opens into the pipe, B, which communicates with a second valve chamber, M, above the valve, N, of this latest opening upwards or out of the pipe, B. The chamber, M, communicates by the pipe, O, with a receptacle for the compressed air, similar in construction to the vessel, J. When the apparatus is in action, the water first entering by the valve, F, rises up the long leg, B, of the siphon, with a pressure due to the height of its fall, and forces the air above it through the valve, N, and pipe, O, into the compressing vessel. Then, when the valve, F, is closed, and the valve, H, opens, the water in the pipe, B, descends by its gravity and passes off. A vacuum will be formed above the receding water, when the valve, N, will be closed, whilst the valve, L, will open, and a portion of the air in the vessel, J, will, as it were, be drawn out into the pipe, B. On the subsequent reversal of the valves, F, H, the valve, L, will close, and the valve, N, will open, and the water supply will force another quantity of air into the compressing vessel, and thus the operation will proceed, alternately compressing and rarefying the air in the respective vessels. The compressed and rarefied air thus obtained may be made to serve various useful purposes. Thus, for example, an atmospheric railway may be worked by means of the apparatus; and a very obvious application of it is for the purpose of ventilating mines, and public and other buildings.

SADDLETREES.

GEORGE M'NAUGHT, *Glasgow.—Patent dated September* 23, 1854.

By the process adopted by Mr. M'Naught in the manufacture of saddletrees, increased strength is secured, together with economy in the material used, and in the labour required in making such articles.



Our engraving is a side elevation in perspective of a saddletree, as made according to this system, and covered or canvassed in the usual manner. The portions of the saddletree to which the invention more especially refers, are the semicircular or curved head piece, A, and the two twisted side bars, B. According to the ordinary system of making saddletrees, the head is generally made in two portions, each portion being in one piece with one of the downward projecting side pieces, C. These two portions of the head piece are each shaped out of solid pieces of wood, by splitting, chopping, and cutting away the superfluous portions of the wood, to bring it to the proper form. According to this mode of proceeding, a considerable portion of the material is cut to waste, and the labour required is excessive. Now, the portion of this invention relating to the head of the saddletree, consists in forming the semicircular part, A, out of a piece of wood, which is first cut to the necessary thickness in a flat state, and then, after being steamed or otherwise prepared, is bent to the required semicircular or curved form, by means of screw presses or other suitable machinery, such as is used in other manufactures for bending wood with the aid of steam. Or, instead of forming the head piece, A, of a single piece of wood of the full thickness required, it may be composed of two or more thin pieces, bent and glued, or otherwise attached or bound together, to give the required thickness. Similarly, whilst the side bars, B, are brought into the required form, according to the ordinary system of manufacture, by cutting away portions of the wood so as to give them a twisted shape,—under the improved system they are first cut to the necessary thickness in the flat state, being afterwards twisted by means of suitable machinery, after being steamed or otherwise prepared, so as to bring them to the twisted shape required in the construction of the saddletree, as indicated in the figure. The back, D, of the saddletree is made in the usual manner, and the several pieces, A, B, C, D, being glued or otherwise connected or jointed together, the corners, E, are filled up with separate pieces, so as to economise the width of the wood, out of which the side bars, B, are formed, and filling-up pieces are fitted in in the usual way, on the inside of the pieces, A and C. The saddletree is finished externally in the usual manner, by being covered with coarse canvas, and washed with glue, or otherwise prepared. We have thus far only referred to the manufacture of saddletrees for the ordinary description of men's riding saddles; but it will be obvious that the invention, or a part of it, is equally applicable to the manufacture of other varieties of saddletrees. Thus, for example, the side bars of saddletrees for ladies' or side saddles, as also those of saddletrees for military saddles, may be made according to the improved system of manufacture, as already described.

REVIEWS OF NEW BOOKS.

MENSURATION MADE EASY; OR, THE DECIMAL SYSTEM FOR THE MILLION, WITH ITS APPLICATION TO THE DAILY EMPLOYMENTS OF THE ARTIZAN AND MECHANIC. By Charles Hoare. New Edition. Pp. 84. London: Effingham Wilson. 1855.

This is a painstaking exposition of the many advantages derivable from the use of decimal notation, and we must therefore welcome it with all the cordiality which we know to be due to the real promoters of the desirable end of simplifying processes of calculation.

"Many calculations," says our author, in his address, "in themselves really simple, present such difficulties to those who are not accustomed to the use of figures, when the quantities are represented by fractional numbers, as

$\frac{3}{4}$ three-fourths,
$\frac{7}{8}$ seven-eighths,
$5\frac{4}{9}$ five and four-ninths, &c.,

that they are at once deterred from the attempt, or give up the task as hopeless; when a little inquiry and explanation would satisfy them that the necessary knowledge may be soon and easily acquired.

"Owing to an imperfect system of education, or to the neglect of opportunities, the most useful, and at the same the easiest course of teaching, namely, *Decimal Arithmetic*, is omitted in youth; and in riper years it is looked upon by the mechanic as some mysterious process. To remove this impression, the following pages have been written expressly for the use of the artizan classes; and a careful perusal will convince them, that with moderate practice it is possible for any one, acquainted with the most simple rules of arithmetic, to obtain with ease and accuracy the result of calculations connected with their daily occupations, which they have been hitherto accustomed to consider as wholly beyond their reach.

"Deficiency in a branch of knowledge bearing such close relation to almost every department of Art and Manufacture, must prove a source of constant regret; and is undoubtedly too often fatal to the best interests and advancement of the otherwise intelligent and clever workman; compelling him, frequently, to trust to those who are inferior to him in mechanical ability; or the alternative of conducting operations in doubt, the result of which might have been anticipated with certainty, and in their progress would have afforded pride and pleasure under skilled direction. Without this knowledge the resources of the anxious and the careless are alike; for, in the absence of detailed instructions or constant supervision, both are limited to 'guesswork,' or 'roughing it;' failure subjecting the most zealous to blame for inattention or incompetency, however earnest his endeavours may have been. But to the artizan acquainted with decimal arithmetic, the book of knowledge is no longer wholly sealed; science yields readily, even to his rude grasp, some of her treasured secrets; the mysteries of his particular occupation may be unravelled; art is no longer veiled, and labour, invested with the charm of interest, soon ceases to be irksome toil; for when intelligence guides each performance, it will secure for him the confidence of his employers, together with a greater meed of approbation and reward."

Every thinking mechanic must closely acquiesce in these remarks, for they tell a very true tale, and rightly apply it.

Mr. Hoare gives the fullest introductory matter in explanation of his subject; and in this point he observes a wholesome rule, which is but too often neglected by public instructors. Armed with the exemplary definitions given at this part, the inquiring student will have no difficulty in mastering the rest of the volume, and thus making himself master of practical decimals.

The chapter on the "Practical Application of Mensuration" is a particularly useful section, as it enters into such details as are of most common occurrence in the general avocations of the tradesman and mechanic. The tabular matter, forming the tail-piece of the volume, decimalises our existing reference tables, and thus leaves none of the lessons to be guessed at.

BRITISH WORKMAN, AND FRIEND OF THE SONS OF TOIL. Pp. 4, folio. Monthly Parts I. to III. Woodcuts. London: Partridge, Oakey, & Co. 1855.

"To promote the health, wealth, and happiness of the working classes" is the avowed object of an illustrated monthly paper, which appropriately bears the title quoted above, and which has opened with a more than ordinary promise of usefulness, as far as the first three issues now before us. We have had a pretty good experience of what penny publications have generally proved to be in this country; but that experience is very far from reaching the standard of the "British Workman," which, for a penny, gives us four large pages of readable matter, carefully selected for the class on whose tables it is intended to lie, and illustrated by an average of fifteen wood engravings, very fully sustaining the credit of the art in even its higher ranks. The "Loaf Lecture," illustrating the folly of spending in the beer shop what ought to go to the baker, furnishes a good subject for the pencil of Mr. George Cruikshank, who brings out, with his well-known force, all the points which the thriving teetotal workman has to urge against the habits of his less abstemious workshop mate.

Not less striking, as a telling example of art, is the engraving illustrating how may be accomplished the feat of "swallowing a square yard of land"—where the good and virtuous navvie, in lecturing his naughty drinking friend, chalks upon his spade his calculation, that the threepence disposed of in the purchase of a pint of beer, would buy a square yard of land at 60s. an acre. An extremely well-executed head of J. B. Gough, the American apostle of temperance, is another noticeable engraving, usefully employed in attracting readers to a somewhat dry sermon. So also is the sketch enforcing the principles of the "early closing movement."

From what we have said, it will be understood that the paper deals largely in temperance matters, and it is right that it should do so, for without this basis, the "British workman" may be sermonised on all else in vain. By guarding against mere severely dry strictures, and adhering closely to the elevated style of attractive features with which the beginning has been made, a wide and solid success may be achieved by this promising publication.

Facts and Figures concerning Rotherham and Masborough. By John Guest. Pp. 12. Rotherham. 1855.

This is a "letter to the ratepayers" of Rotherham, that old Yorkshire town which, a century ago, afforded the materials for a working man's pamphlet, on "The beautiful situation of Rotherham for trade." The present writer gives us these pages with the view of showing that the town "is equally as advantageously situated for health." He gives some useful hints with reference to sanatory matters, the neglect of which has hitherto prevented the locality from attaining the healthy condition to which it has a claim.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTE OF CIVIL ENGINEERS.

March 27 and April 3.

In the continued discussion on Mr. Allen's paper on the use of the screw-propeller in large sailing vessels, it was observed, from the statements in the paper, that a special class of commanders of such vessels must be formed, in order to employ advantageously the combined powers of steam and wind; otherwise, in the attempt to bring the propeller to the aid of the sails, injury would probably result.

A fully-rigged ship, with square sails set, whilst on a wind, could rarely lay up nearer than six points from the wind, but with fore and aft sails she came up to within four points. If any auxiliary power was used, whereby the speed of such a vessel would be augmented, beyond that due to the sails, she would fall away from her course, just in proportion to the extra propelling power applied. This had been observed in H. M. steamer *Inflexible*, when using part of her steam power to aid the sails, and making about eight knots per hour; she passed many vessels, all standing up full two points nearer the wind than she could do; but on ceasing to use steam, she came up even higher in her course, under canvas alone, than the other vessels, and directly the steam was used, she fell off again.

An interesting account was given of the early voyages of the *Red Jacket*, *Blue Jacket*, and the other celebrated clipper ships, whose arrival in port could be now reckoned upon almost with the certainty of steam vessels. It was contended that, as a matter of commercial profit, well-appointed sailing ships were preferable to steamers for the China voyages; but that the latter were most advantageous and comfortable for passengers, especially for voyages not longer than between England and the United States. The American clipper ships were from 200 to 300 feet long, had fine lines, sharp bow and stern, with a rather flat floor, and carried an enormous extent of canvas. Some of them had been built in a hurried manner for the Californian trade, and had caused an unfavourable impression of that class of ship; but it was stated from authority, that when carefully constructed, at an adequate price, there could not be better, more seaworthy, or drier ships; cargoes of grain had been constantly conveyed without a kernel being wetted. When, however, a vessel of 300 or 400 feet long was built and launched in about four months, it was not surprising that cargoes were damaged. These vessels, with their heavy spars and great spread of canvas, required much care in navigating, and energy and determination were almost as necessary in their commander as seamanship.

Models were exhibited of the feathering screw, adapted successfully, by Messrs. Maudslay, to several vessels, extracts from whose logs were given; whence it appeared that great benefits, both in speed and convenience, resulted from the use of the system. The same had been experienced on board the *Jason*, fitted by Messrs. Watt & Co.

The differential-pitch screw, by which any degree of pitch could be given to the propeller, was shown; it had been found very useful in variable weather, when used on board the *Prince*, which was lost in the great storm off Balaklava.

It was suggested that the displacement of the vessels should have been given in the tables, as without that information it was difficult to compare the results. Shipbuilders ought to give a scale of displacement, for the guidance of merchants in ascertaining the work done by their ships.

An account was given of the early use of auxiliary steam power, and of a screw propeller, adapted in 1844, by Captain Hays, to a small vessel in the Irish trade. This, in some degree, led to the introduction of the first feathering screw. More attention was suggested to the position of the masts on board auxiliary power ships, and to their being more especially adapted for using their sails only, and having recourse to the steam power only under certain circumstances. The *Crœsus* carried a large extent of canvas, but, on account of the improper position of her masts, her sailing qualities had not been fully displayed. The great merit of the differential-pitch propeller was its power of being adapted to suit the sailing speed of the vessel, and thus to prevent the vessel from making lee-way. By the late plans of Messrs. Maudslay, the screw could be feathered and unfeathered under any circumstances, without any difficulty, and whilst the vessel was taking full advantage of wind and steam. Whenever it was necessary to hoist the propeller out of the water, it was usual to wait some time for the observation of the wind and various circumstances, before hoisting, but the operation of feathering the screw occupied so short a time, and required so little power, that the captain never hesitated in making the changes of position five or six times in the course of the day. If this kind of propeller was more used, there would be little doubt of great extension of the auxiliary steam power system for long voyages.

A suggestion was offered as to the advantage that would result from the accurate statement of the area of the midship section of the ship, and of the indicated horse-power of the engines, when describing any vessel; this would avoid much of the ambiguity of the statements frequently put forward. It was notorious that the actual power was from 1½ to 6 times that of the nominal power of marine engines.

It was contended that the system of full-rigged clipper ships, with auxiliary power and screw propellers, keeping habitually in the ordinary sailing track, and taking full advantage of wind power, had already been acted upon, as far as was possible, with the *Great Britain*, a ship not originally constructed for the purpose, and that in a few weeks the *Royal Charter*, an iron clipper sailing ship, built expressly with these views, would be launched for Messrs. Gibbs, Bright, & Co., Liverpool. This ship, intended to trade with Australia, would be 2760 tons burden, 336 feet long, 26 feet deep, 41 feet 6 inches beam, and 200 H.P., with three masts, square rigged.

The first voyage of the *Great Britain* had demonstrated the great expense of using full steam power on the Australian route, and on her return she was, as far as possible, converted into a clipper sailing ship; instructions being given to her commander to take the route of sailing ships on the great circle—to rely more upon sails than steam—to disconnect the screw whenever 7 knots an hour could be attained by canvas alone—to work at all times expansively—in short, to do as much as possible by the sails, and only what was obligatory by steam. The voyage was accomplished in 65 days, with a consumption of 1393 tons of coal, chiefly anthracite. On the subsequent voyage, acting on the same system, in 60 days she was within 260 miles of Port Philip; but stress of weather drove her from her course, and she only made the port in 65 days. The consumption of coals was very much reduced, and the fire-bars were uninjured, although the distance run was 14,300 miles. It was remarked, that the masts of the *Great Britain* were of necessity not well placed—that her engines were much too powerful—and that, when under sail, her screw acted to some extent as a drag; but, in spite of these disadvantages, the experience gained by her voyages had induced the construction of the *Royal Charter*. This it was contended had been publicly known for some considerable time, and to Messrs. Gibbs, Bright, & Co., of Liverpool, was due the credit of putting in practice the full-rigged clipper ship with auxiliary power for long voyages.

The first voyages of the *Great Britain* having shown the advantage that might be derived from giving her more canvas, and working the steam-power less, on the Australian voyage, her lower yards were made 100 feet long, her topsail yards were increased to 80 feet in length, and her suit of sails was made to contain 14,000 yards of canvas, which was quite as much as was displayed by any clipper ship. Such were the general qualities of the *Great Britain*, that if the position of her masts could be altered, it was contended she would, under canvas alone, be probably the fastest ship afloat. She had really run 17 knots per hour, when dragging her screw through the water.

The system of lifting the screw bodily out of the water was objected to, on the score of liability to accident, although on board some of the ships of war it was a common occurrence to lift the screw in about nine or ten minutes, with the power of thirty men at the windlass. It had now been determined to try the system of having a small engine, merely to turn round the propeller at a speed corresponding with that of the vessel whilst under sail, and this, it was anticipated, would be a great advantage commercially.

It was urged, that the nominal tonnage of vessels, and the nominal horse power of engines, were such indefinite terms, as to be utterly inapplicable data for comparing the merits of the performance of steam-ships. In order to illustrate the extent of fluctuation of tonnage with reference to displacement, and of nominal horse power to the effective working power of engines, an examination had been made of the constructive elements of ten ships, all having power in the proportion of 100 tons of displacement to 40 nominal H.P., when the results appeared to be:—That as respected the ratio of tonnage to displacement, 100 tons, builders' tonnage, gave different amounts of displacement, varying between 57 tons and 157 tons. That as regarded the ratio of nominal H.P., as contracted for, to working

H.P., of the unit 66,000 lbs. raised one foot high in one minute (or 2 H.P. indicated), 100 nominal H.P. gave different amounts of working H.P. of the unit (66,000 lbs.), varying from 93 H.P. to 300 H.P.; and that, as respected the ratio of displacement to working H.P. (of the unit 66,000 lbs.), the different amounts of working power, to 100 tons of displacement, varied from 22 H.P. to 185 H.P.

Hence it was argued, that the ratio of tonnage to nominal H.P. did not afford any indication of the ratio of displacement to working H.P. of any definite unit.

A doubt was raised as to whether the auxiliary power would ever be found so commercially effective on the long Australian voyage, as it had been on the comparatively short passages, for which it had been first designed; the question of the currents must be well considered, and it would be long before the best system of navigating such vessels would be completely established. Some objections were raised to the feathering screw, and it was contended that a screw capable of being lifted out of the water in a frame was superior; but it was admitted that a certain amount of power was required for the operation. Hydraulic power might, however, be beneficially employed. The propeller, with a rule-joint in the dead wood, was objected to as being liable to accident.

It was a question whether, looking at a comparative chart of the Australian voyages of sailing clipper ships, it would not be found sufficient to give even smaller auxiliary power—only just sufficient to enable a vessel to work in and out of harbour, do the work of loading and unloading cargo, &c., and let her rely, for the voyage, almost entirely on her canvas.

On the other hand it must be considered, whether such a condition would not be precisely that of the early auxiliary power vessels, of which it had been said "they had just as much power as would get them into difficulties, but not enough to get them out again."

In war time it might be necessary to run from privateers, and in such cases small power would be utterly ineffective. All these were points to be considered by commercial men, as well as the capability of conveying a certain amount of cargo, at a certain cost, in the shortest period of time.

The valuable assistance of Lieutenant Maury's charts was forcibly alluded to. The difficulty in obtaining details of construction of machinery, of the midship section, and of the displacement, &c., of vessels, was pointed out, to relieve the author of the paper from the allegation, that he had not fully supplied all the particulars demanded for the discussion of the question.

It was suggested that, at the next meeting, members should come prepared to discuss the best proportions of steam power to tonnage,—the best commercial speed,—the means of disposing of the screw when the vessel was under sail,—the best form of recording observations,—and the general commercial question.

Models were exhibited of Mr. de Bergue's propelling apparatus, the moveable portion of which consisted of a long blade, tapering towards its extremities, to which was communicated, by means of a crank and connecting rod, a motion in a direction nearly vertical to its faces, and at the same time by means of a radius rod, an oscillating motion on its centre, causing the two faces of the blade to act simultaneously and alternately in an oblique direction against the water, the one acting by compression, the other by suction.

This blade, being enclosed in a submerged case or chamber open at each end, produced, by the rotation of the crank, a continuous flow of water through the chamber in either direction.

The displacement of water was very considerable, each revolution of the crank discharging double the contents of the chamber. This apparatus was stated to be applicable as a propeller for steam-boats, or for the displacement of any large body of water, or for a blowing apparatus.

It was stated to possess several advantages over both paddle-wheels and screw propellers:—in cheapness of construction—simplicity—constant effect, from being entirely submerged—saving in weight—expending usefully the entire engine power exerted—absence of vibration in the vessel—capability of working in shallow water—freedom from risk of heated journals—and as being peculiarly adapted for tug-boats, in which latter case the propeller would be placed quite beneath the centre of the vessel, in which position it would also be advantageous for floating batteries and gun-boats.

Models were also exhibited of Griffiths' screw propeller, which had been used on board the *Great Britain*, and was stated by the late commander of that ship to have been very successful; the vessel could be sailed with the screw fixed, without much injuring her speed. Recent improvements in the form had further diminished the drag, and there was an almost complete absence of vibration or tremulous motion. The propeller consisted of two moveable blades, inserted in a spherical centre or boss, by which form it was rendered very strong, and the blades could be adjusted to any pitch required by the vessel or engines. It had been fitted to a large number of vessels, and among them to H.M. yacht *Fairy*.

Some propellers, with curved steps on the blades, were introduced by Mr. Walduck, who described the principal advantage to consist in thus obtaining a firm hold upon the water, and retaining it until it passed off at the edges of the blades. Greater speed had been attained, with an almost entire absence of tremulous motion.

It was argued that a vessel carrying 3000 tons, besides machinery and coals, would require 1000 H.P. (indicated) to obtain $8\frac{1}{2}$ knots per hour, and even by that means could not save more than $7\frac{1}{2}$ days in a voyage like that of the *Red Jacket*. Arguing from these premises, and demonstrating the position by a diagram, showing the courses of various ships, it was contended that the commercial advantages of employing auxiliary steam power on voyages to Australia were questionable, inasmuch as the small saving of time on the voyage could not command such an increase in the rate of freight as had been named.

The prevailing westerly winds and currents in the Southern Ocean might always be depended on, if a proper course was taken, as laid down in Lieutenant Maury's charts, and it was not improbable that, from a continuance of the same admirable observations as had served for the foundation of these charts, and the classification of the valuable documents said to exist in the archives of the Admiralty, such further information would be obtained as would eventually still shorten and render more certain the voyages of the sailing clippers.

It was admitted that small auxiliary power would be very desirable for enabling clipper ships to work into and out of port, and to make some way in what were called the "Horse Latitudes;" but the expectation of great advantage being derived on the Australian voyage was contended to be fallacious. These remarks were not meant to apply to auxiliary screw clippers intended for other routes, but rather to enforce the position of its being always necessary to consider carefully the peculiarities of the intended station, and to adapt the power and means of propulsion to them. The question of the speeds of American vessels was again raised, and it was contended that the transcripts of the logs alluded to were correct, and did fairly represent the speeds attained.

It was shown that the *Great Britain*, having 14,000 yards of canvas in a suit of sails, exceeded in extent of sails any of the clipper ships, and that although it had been predicted for her that she would be a very fast steamer, yet it was not supposed that she would attain the great speed under canvas which she had actually exhibited; it having been stated that she had run 17 knots per hour whilst dragging her screw through the water. The peculiarities of the method of building American vessels were described, and instances given of the facility of repair of well-built vessels, as compared to some of the cheap rapidly-built ships that had been turned out for the Californian trade.

Reference was made to the forms introduced to the Institution by Captain Henderson in 1847, and again in 1853, with the object of obtaining the particulars of area of midship section, lines of displacement, power of engines, &c., which were now asked for from the author of the paper, who had furnished all that could be obtained; it was suggested to members to supply these, in order to render the paper complete for reference.

It appeared to be shown that neither the full-powered steamers nor the large auxiliary-power sailing ships hitherto placed on the Australian route had been commercially successful; and therefore a class of minimum-power auxiliary screw-propelled ships, fully rigged, was advocated, with the view of sailing at all times, should the wind serve, and only to employ their steam in calms, and under favourable circumstances. When the sun was far north, the trade wind ceased, and calms commenced in $15\frac{1}{2}$° to 16° north latitude, and continued as far as 3° to 4° north, or over a space of nearly 700 miles in the usual track of ships from the North to the South Atlantic. In the contrary season, with the sun far south, the trade wind usually failed in about 6° north latitude; and thence to the equator, or 2° south, constant calms prevailed over 400 to 500 miles, the ships only getting over that space by occasional squalls of short duration.

Now, it was in these positions that the minimum power was required; and by its judicious use it was very possible to save 10 days on the Australian voyage, and make a corresponding profit.

As to comparison of the lifting the screw of the *Dauntless* in a frame, by 30 men in 9 minutes, as compared with turning up that of the *Caroline*, upon a rule-joint in the dead wood, with 3 men in 3 minutes, there could not be any question as to which was the best system for a trading vessel; and it was contended that the screw should remain always coupled to the driving shaft, to avoid the rattling and noise arising from having easy allowance for coupling.

As to American vessels coming to Great Britain, it was contended that it was beneficial for both shipbuilders and merchants that the American vessels should beat those of this country, as otherwise the desire of having immense cargoes carried in vessels of nominal small tonnage would do away with all scientific improvements in construction.

The Americans had, moreover, shown that something of cargo must be sacrificed to speed, and this country was much indebted to them for the lesson; as also for demonstrating the necessity for having the best practical seaman for the captain, and making it his interest to get as much out of the craft as her power and speed would give.

It was contended that, as far as it had been practicable to procure such information, the displacement and the immersed area of ships had been given in the paper, but there was great difficulty in obtaining such data correctly from the builders. The consumption of coal for the distance run was also stated, as far as was practicable; because this was recognised as the only true means of ascertaining the commercial value of auxiliary power. Nominal horse-power has been referred to, more as a standard of first cost than as affording any measure of the power really employed.

The general assumption was, that having engines of 200 H.P. (nominal), and with the expenditure of 350 tons of coals, a sailing clipper ship, with an auxiliary screw propeller, might save 10 days on an average passage to China or to Australia, supposing the steam only to be used in calms, and under circumstances to enable a maximum effect to be produced by a minimum expenditure of fuel; it being taken as proved, that a minimum-powered clipper ship could not possibly be commercially successful if overloaded with coals, or consuming such a quantity of fuel as had been required by the auxiliary-power ships hitherto in use.

Full credit was given to the charts of Lieutenant Maury for pointing out the steady wind course, but it was contended that even on that track, at certain periods, there were winds so light that the best ships could not make more than two knots an hour.

It was maintained that the author of the paper had not received any intimation of the construction of the *Royal Charter*, and that the fact of the adoption by so eminent a firm as Messrs. Gibbs, Bright, & Co. of the dimensions of the ship and the power of the engines, so exactly similar to those advocated by the author, was the best proof of the soundness of his views.

It was contended that this commercial question was of great importance, but it would have been desirable that it should have been preceded by a paper on the forms and capabilities of screw propellers; it was, however, suggested that such a communication should still be made, when the whole question would be reopened, and the experience of the relative merits of the various systems of lifting the screws, and the results of dragging them through the water, could be fairly laid before the meeting.

Doubts were expressed as to the anticipated advantages of having a very small engine merely to give a slow speed to the screw when the vessel was under sail, and calculations were given to demonstrate its inutility, based on the results obtained by Messrs. Maudslay & Field, in their experiments on the feathering screw.

The benefits arising from the friendly rivalry between America and Great Britain, in shipbuilding, in engineering, and in general manufacturing and production, were frankly admitted, and fervent hopes were expressed that that would be the only kind of rivalry the two countries would ever be engaged in; it was the only contest in which the least successful was the greatest gainer.

After the meeting, there was exhibited in the library a model of a system introduced by Mr. Clifford, for lowering ships' boats from the davits, evenly, quietly, and safely, in a gale of wind, and disengaging them without any risk of capsizing, or being dragged under by the speed of the vessel.

The chief point was the employment of a block of a novel form, having three sheaves placed over each other, through and between which the lowering ropes passed in such a manner as to have a tight grip upon them, and yet so that by letting all run free, the falls would run out in such a manner as to let the boat down on the water on even keel, and quite free from the ship. The lowering could be accomplished by a man sitting in the boat, and though with a full loading, the descent could be checked at any point. It was evident, that by this system the disastrous effects of undue haste in rushing to the boats in cases of danger would be completely obviated.

A simple ingenious system of a hollow rotating boat-plug for the bottom of the boat was also shown.

APRIL 17.

JAMES SIMPSON, ESQ., PRESIDENT, IN THE CHAIR.

"On the Construction of Railway Switches and Crossings," by Mr. B. Burleigh.

This portion of the permanent way of railways was shown to require great attention, not only on account of the cost, but for that more important reason, the safety of the travelling public, which was seriously jeopardized by any want of care in the maintenance; it was, therefore, most desirable to insure, in the construction of all parts of the permanent way, the greatest amount of efficiency, combined with the largest ultimate economy.

This remark was more peculiarly applicable to the construction of switches and crossings, as they not only formed important features in the system, but they were originally expensive, and were liable to rapid destruction under heavy traffic, whilst corresponding injury was done to the rolling stock, by their being in a bad state of repair. With these views, many attempts had been made to introduce improvements, which had been more or less successful. Among those chiefly deserving attention were, Wild's system of housing the tongue-rail of the switch beneath the top flange of the fixed rail; Parsons' solid-point rail switches and crossings; Baynes' switch, with its deep tongue-rail, intended to clear the sliding chairs of any dirt lodging upon them; and Carr's crossing, in which pieces of metal were welded under those portions of the upper table of the wing and point rails most exposed to abrasion and compression. These, although advantageous modifications, were still susceptible of improvement, particularly in the weakest parts, which were the outer rails of the switches, and the wing rails of the crossings, in the line where the outer edge of the wheels crossed them in a diagonal direction. The severe blows to which these parts were exposed, were caused, in a great measure, by the undulation of the rails during the passage of the weight, which was alternately sustained by the point rail and the outer rail. The movement, or shifting of the relative positions of the various parts of a switch or crossing, resulting from these causes, was most injurious, as the least subsidence of the rail on which the wheel rested, caused a severe concussion when the outer edge of the tyre first struck or mounted the adjoining rail, whilst crossing it diagonally. This concussion was simultaneously both lateral and vertical, and being given at a high velocity, and the springs not being able to relieve the axles, wheels, and other parts of the engines and carriages, general injury was occasioned; and to this cause might be attributed the greatest number of accidents arising from fractures of the rolling stock.

A great defect in ordinary switches was the lateral weakness of the tongue-rail, which was sometimes sprung to such an extent by the leading wheel, as to open the point sufficiently for the next wheel to run on to the wrong line, and cause serious accidents.

The importance of attention to these portions of the permanent way, would be better appreciated by alluding to the quantity in use throughout the kingdom. This might be inferred from the fact of there being, in the London station of the Great Northern Railway, upwards of five hundred sets of points and crossings. In certain situations, under very heavy and constant traffic, and with certain qualities of ballast, the outer rails of some of the switches and crossings were frequently worn out in six weeks, by the cutting action of the outer edge of the wheels. It was, however, generally found that a good, sound, and well-drained foundation tended materially to reduce this destructive action.

In the case of a tyre, worn hollow, passing over a switch or crossing, the wheel was actually lifted off the inner rail, and carried on the adjoining rail, resting only upon the outer edge of the tyre, at which moment the concussion occurred which produced the lateral strain upon the wheel, and the crushing action which channelled out the rail in the path of the outer edge of the tyre.

A want of rigidity was as severely felt in switches and crossings, as in the main portion of the permanent way; and hence the advantages of "fishing" the ends of the rails, so as to secure continuous resistance to the impact of the wheels, and to the insistent weight of passing loads.

Considerable experience and careful observations of these and other minor defects, induced the introduction by the author of a switch with a projecting piece, rolled upon the tongue-rail, for supporting the flange of the wheel during its transit over the spot; the surface of the projecting piece being sunk to such a depth below the top of the rail, as to correspond with the depth of the flange of a new wheel, which would therefore take a bearing on both the rail and the projecting piece simultaneously. When a tyre was worn hollow, the outer or cutting edge was thus borne up nearly in its original position, and was prevented from cutting into the outer or adjoining rail, which it crossed in a diagonal direction. The surface of the projecting piece was so depressed at its extremity, as to receive the flange of the tyre very gradually, and thus to avoid any concussion; whilst the outer rail was protected from injury, and considerable lateral stiffness was imparted to the tongue-rail. This system had been proved to be very successful practically, and appeared to obviate most of the defects of previous switches and crossings.

The advantages of having extra connecting rods at all meeting-points, at junctions, or stations on the main line, were insisted on; and it was recommended that they should be fastened by a split-key, rather than by a screw and nut. The frequent fractures of the cast-iron hinge chairs of switches had induced the successful introduction of wrought-iron for the purpose; the hinge being so constructed as to render it almost as perfect as a "fished" joint, and all risk of breakage was obviated.

The introduction of a filling-piece, or flange-bearer, between the wing and point rails of a crossing, was also shown to be an improvement, tending to prevent concussion, whilst it acted as a "fishing" plate for the entire crossing, which was rendered as rigid as a beam. The importance of this continuous rigidity was evident from the cessation of the alternate movements between the wing and point rails, which were usual on the passage of trains, and which caused so much mischief.

The "fishing" plates were rolled alike on both surfaces, for the purpose of being reversed; the substitution of wrought for cast-iron chairs insured immunity from fracture and ultimate economy; wooden keys were entirely dispensed with; and after severe trial, under very heavy traffic, on the Great Northern Railway, particularly in positions where the outer rails had been previously destroyed in six weeks or two months, the switchings and crossings introduced by the author had stood the test of long and heavy wear, without exhibiting any symptoms of failure, and the experience already acquired of their properties induced complete confidence in the advantages they presented.

SOCIETY OF ARTS.

APRIL 4, 1855.

"On the Diseases of Miners," by Mr. Herbert Mackworth. The author commenced by asserting, that the serious waste of our mining population, and the consequent drain on other classes, the rate of wages, the cost of mining, the demand for minerals of all kinds, apart even from motives of humanity, rendered the subject of mitigating or averting accident and disease from miners, one of national importance. It should also be remembered, that the mining population amounted to nearly 300,000. The different portions of a mine are all distinguished from other workshops by the peculiarities of the temperature, pressure, moisture, and composition of the air, of the gases and miasmata which exist in them; by the absence of sunlight, and by the mode of lighting, quite as much as by the motions and working positions, being different from those belonging to any other occupation. The great sacrifice of life occasioned by the use of ropes and chains for ascending and descending the shafts, and the effect on the miner's health of ascending many hundred yards of almost perpendicular ladders, at the end of a day's work, were commented upon, and it was shown that it was an economy to make use of the "man machine," first introduced into the Hartz mines, and subsequently into Cornwall, at the united mines, Tresavean and Fawey Consols, by the efforts of Sir Charles Lemon and the members of the Cornwall Polytechnic Society. The constrained attitude in working in the narrow seam of coal in Yorkshire, near Bristol, and other parts of England, and the almost horizontal position of the "hurriers" (boys who draw the coal from the working faces to the shaft), might be avoided by cutting out the roadway to a height of forty or forty-two inches, and employing small ponies for the heaviest portion of the work, of which there were large numbers in the north of England mines; and the expense that would be incurred in doing this was, in the author's opinion, more imaginary than real. Injury to health was, in a great degree, due to defective ventilation, and special attention should therefore be paid to this point, care being taken that the air-courses are sufficiently capacious, that the air is made to traverse round the working face, and the system of splitting the air into a number of currents is adopted. Defective ventilation frequently arises from leakages in the air-passages. This might be detected by the judicious use of the thermometer alone. The author then adverted to the loss of strength and energy produced by the increase of the temperature of mines, and quoted the opinions of eminent continental authorities on the subject. Other causes of disease were then enumerated; of these, the principal were the deficiency of oxygen in the air in mines, the carbon generated by the imperfect combustion of tallow or oil of bad quality, the dust thrown up by explosions, and the exhalations and miasmata proceeding from the putrid fermentation of animal and vegetable matter underground. The effect of these causes may be estimated from the fact, that the aggregate amount of sickness experienced by miners between the ages of twenty and sixty, is 67 per cent. more than that experienced by men in general. The average age of miners living varied from 25·7 years in the case of tin miners, to 28·9 amongst lead miners, whilst 42·3 years were got out of the agricultural labourer. In other words, the lives of miners, in addition to excessive sickness, were shortened by an amount equivalent to more than half their working lives. The author concluded by recommending that, having in view the sanitary improvements of mines, the ventilation should be such, in all mines, as to insure a regular current of pure air at all times and in all parts of the mine, that dung-heaps, putrescent timber, and similar nuisances should be removed once a month, and that the sanitary condition of the mine should be examined and reported upon by a medical officer at least twice a year.

April 11.

"On the Mineral Industries of the United Kingdom," by Mr. R. Hunt.

April 18.

"On the Revision of Architecture, in connection with the Useful Arts, with some Account of the Ventilation of St. George's Hall, Liverpool," by Dr. D. B. Reid. After referring to a laboratory which was erected in Edinburgh in the year 1833, the author proceeded to state, that the occupation of this building had led to certain conclusions, among which the most important were as follow:—That the amount of air supplied in general to crowded buildings was far below the standard requisite for the preservation of health. That the ingress of air, by an extensive system of diffusion, was the great desideratum in practical ventilation; and that, in all public buildings, it should be admitted by special apertures and channels, in which it could be tempered to any extent required. That in any system of illumination, the imitation of the diffused light of day was the point to be arrived at; and that all the products of combustion from such illumination should be completely removed from the general atmosphere of the apartment. That a low roof, combined with a powerful reflection of sound there, and a floor highly absorptive of sound, and apertures by which it could escape, tended powerfully to improve the communication of sound. Ventilation, acoustics, and illumination, ought, in the author's opinion, to form primary subjects of consideration in all public edifices. As a means of facilitating the revision of architecture in its position as a useful art, and of placing the useful and the beautiful in a more harmonious conjunction than they present in public buildings, and in the habitations of the people, Dr. Reid suggested that no portion of any public building should be commenced till a more complete series of models or drawings was provided than had hitherto been customary. That the present mode of remunerating architects often led to the too precipitate commencement of foundations, before any system of warming, ventilation, acoustics, lighting or drainage, was fully considered and determined. And that an extended system of instruction should be provided for the future student of architecture at all the principal colleges or universities in this country, such as had been partially commenced of late years, and the curriculum placed on the same footing, as to honour and position, that was awarded to the members of other learned professions.

INSTITUTION OF MECHANICAL ENGINEERS.

Birmingham, Jan. 24, 1855.

At this meeting the annual report of the Council was read, showing a very satisfactory state of the Society's affairs. It appears that the number of members of all classes, for the past year, is 228, fifteen of these being honorary, and three graduates.

The papers thereafter read were—

"On an Improved Steam Hammer," by Mr. Robert Morrison, of Newcastle. This useful machine was fully illustrated by us in our Plate 155, page 97, Vol. VI., *P. M. Journal.*

"On a New Manufacture of Compound Metallic Rods and Bars," by Mr. E. J. Payne. This is a system of manufacturing rods and bars of iron and other metals with sand cores, or central portions, for the purpose of saving metal.

"On an Improved Safety Valve," by Mr. James Fenton.

"On an Improved Tuyere for Smiths' Hearths," by Mr. John Ross.

ROYAL SCOTTISH SOCIETY OF ARTS.

March 12, 1855.

"On the Theory of the Driving Belt," Part I., by Mr. E. Sang.

"On a Method of taking Permanent Impressions of Flowers and Leaves on Glass, in Ornamental Designs in Glass Staining," by Mr. R. Smith. This was fully described by us at p. 19, last month.

March 26.

"On the Theory of the Driving Belt," Part II., by Mr. E. Sang.

"On an Apparatus for Drawing any Object or Landscape in Correct Perspective," by the Rev. W. Taylor, London. This apparatus consists of a wooden box, fifteen by twelve inches, and one inch deep. The lid is made, when open, to stand at right angles, and fixed there. On the opposite side of the box, a slip of wood is fixed, having a hole at the top, through which the eye looks at the object to be copied. Opposite to this, parallel tubes are fixed upon the open lid of the box, operating as a photograph. At the upper end of the parallel tubes is a hole through which the eye sees the object to be copied, and this orifice is made to travel along the outline of the object. The other end of the parallel tubes has a pencil fixed in it, which is pressed by a spring to a piece of paper fastened to the inside of the lid by button pins, and which accordingly traces the outline of the object, being the counterpart of the object itself, traced by the other end of the parallel tubes. By means of this instrument, the author stated, that any object or landscape can be more correctly copied than by the Camera Lucida, or any other instrument known to him; that a few trials will be found sufficient to enable a person to use the instrument, and that it has the advantage of being portable, easily made, not difficult to use, and not expensive.

"On some New Platometers," by Mr. P. Macfarlane, Comrie.

The following donation was laid on the table, viz.:—A four-inch Electro-Magnet, said to have sustained 1500 lbs. weight, made many years ago, for the purpose of ascertaining what number of coils would produce the greatest effect with reference to the weight of iron required for these coils; in the course of which experiments, it was found that the best relative effect was produced with four coils, and that an *even* was better than an *odd* number of coils. Presented by the inventor, Mr. Richard Roberts, Globe Works, Manchester.

ROYAL INSTITUTION.

March 16.

Sir Henry Holland, Bart., F.R.S., Vice-President, in the Chair.

"On the Constitution of the Hydro-carbons," by Dr. Wm. Odling, F. C. S.—Every chemical compound may be regarded in a great number of different aspects. Each of the different theories that have been propounded concerning the chemical constitution of bodies, is true in reference to one particular aspect,—untrue in reference to all others. Theories are of the highest service when they enable us to look upon a larger number of bodies from a single point of view,—of the highest detriment, when they prevent us from making use of all other points of view. To regard a body, or a class of bodies, exclusively in one aspect, or, in other words, to view all compounds by the light of a single theory, is necessarily to neglect a whole host of phenomena and relations. He has the most complete knowledge of a compound, who is capable of changing his position, and looking at the body from every possible point of view.

The theory of compound radicals is of the utmost service in enabling us to look upon a large class of bodies in one single aspect, in affording us one of the best means of arrangement, comparison, and explanation; but it has no pretensions whatever to represent the entire and absolute truth with regard to the constitution of bodies: it simply exhibits them from one of many excellent points of view; it has reference less to the actual constitution of the bodies, than to our particular mode of regarding them.

In proportion to the complexity of the constitution of a body, so is the number of aspects in which it may be regarded—so is the number of rational theories that may be entertained concerning it. All of these theories belong to the same order of truth: they differ from one another only in their greater or less degree of generality. The theory of the greatest generality most nearly approximates to the representation of bodies, especially typical bodies, by empirical formulæ, as unitary molecules.

Adopting the proportional numbers of Gerhardt, we represent the two-volume molecules of muriatic acid, water, ammonia, and coal gas, by ClH, OH_2, NH_3, CH_4, respectively. In accordance with certain theoretical notions, these bodies have been formulated as follows:—

$H \cdot Cl$			
$H \cdot O H$	$H_2 . O$		
(Laurent.)			
$H \cdot N H_2$	$H_2 \cdot N H$	$H_3 \cdot N$	
(Kane.)	*(Wurtz.)*		
$H \cdot C H_3$	$H_2 \cdot C H_2$	$H_3 \cdot C H$	$H_4 \cdot C$
(Liebig.)	*(Dumas.)*	*(Odling.)*	

Coal gas may be represented as terhydride of formyl, analogous to its derivative, chloroform, or terchloride of formyl. The two bodies can be prepared in virtue of analogous equations from acetic and chlor-acetic acids respectively, and the one can be obtained from the other by direct substitution.

Each of the above theories has certain circumstances in its favour; each is true to a certain extent; each represents the body in question from a different point of view; sometimes one point of view is most advantageous, sometimes another. As a veritable representation of the constitution of coal gas, Dumas' view is preferable to either of the other two theoretical views.

The adoption of Laurent's sarcastic suggestion of peroxide of hydrogen as a compound radical, leads to inadmissible or uncertain results; thus—Is potash oxide of zinc, K Z O, a combination of a hypothetical peroxide of potassium with zinc, or of a hypothetical peroxide of zinc with potassium? Is Williamson's double ether, Me Et O, a combination of peroxide of methyl with ethyl, or of peroxide of ethyl with methyl? &c.

Nevertheless, there are greater grounds for recognising peroxide of hydrogen as a compound radical, than there are for recognising ethyl and methyl as such. A large number of bodies may be represented very feasibly as containing ethyl; but an infinitely larger and more varied set of bodies may be represented as containing peroxide of hydrogen: such, for instance, are water, potash, sulphuric acid, formic acid, benzoic acid, hypochlorous acid, &c. &c., and, as has been shown by Mr. Brodie, very many other more complicated bodies. Many equations may be represented very simply by means of ethyl analogous to hydrogen; but a much greater number may be represented by means of peroxide of hydrogen analogous to chlorine. Ethyl has been obtained in the free state, so has peroxide of hydrogen; but whereas nearly all the bodies of the peroxide of hydrogen series can be obtained directly from *it*, not one single ethylic combination has ever yet been obtained from ethyl. Hydrogen and ethyl present certain analogies, but the analogies of chlorine and peroxide of hydrogen are much more complete. Both bodies bleach, oxidise, combine directly with potassium, set free bromine and iodine, and take the place of the bromine and iodine set free. In Ba·OH and in Ba Cl, the Ba can be readily detected; but with regard to H Cl and Et Cl, the Cl can be detected in the former only.

All the facts connected with the mutual relations of

$C_2 H_4$ —ethylene, or olefiant gas,
$C_2 H_4 O$ —aldehyd,
$C_2 H_4 O_2$—acetic acid,
$C_2 H_6$ —hydro-ethylene,
$C_2 H_5 Cl$ —muriatic ether,
$C_2 H_6 O$ —alcohol,

especially since the recent researches of Berthelot, show the superiority of Dumas' ethylene to Liebig's ethyl theory, both as regards its more complete accordance with experiment, and its greater generality. The probabilities in favour of the pre-existence of $C_2 H_4$ and its derivatives, as constituent groups, are much greater than are those in favour of the pre-existence of $C_2 H_5$. Thus, with regard to ethylene, hydro-ethylene, muriatic ether, and their chlorine derivatives, we ought to have the following series, convertible into one another through certain members:—

			$C_2 H_4 \cdot H_2$
		$C_2 H_4 \; H Cl$	$C_2 H_3 Cl \cdot H_2$
$C_2 H_4$	$C_2 H_4 \cdot Cl_2$	$C_2 H_3 Cl \cdot H Cl$	$C_2 H_2 Cl_2 \cdot H_2$
$C_2 H_3 Cl$	$C_2 H_3 Cl \cdot Cl_2$	$C_2 H_2 Cl_2 \cdot H Cl$	$C_2 H Cl_3 \cdot H_2$
$C_2 H_2 Cl_2$	$C_2 H_2 Cl_2 \cdot Cl_2$	$C_2 H Cl_3 \cdot H Cl$	$C_2 Cl_4 \cdot H_2$
$C_2 H Cl_3$	$C_2 H Cl_3 \cdot Cl_2$	$C_2 Cl_4 \cdot H Cl$	
$C_2 Cl_4$	$C_2 Cl_4 \cdot Cl_2$		

Of these four series, three are undoubtedly, and the fourth most probably, known to us. They illustrate rationally the nature of the isomerism. In the three latter series, we have every reason to believe that, with regard to the carbon, two of the hydrogen or chlorine atoms stand in a different relation to the other four; but in the first series, we have not a single fact tending to show that one of the hydrogen atoms stands in a different relation to the other three; not one fact to countenance the representation of olefiant gas by $C_2 H_3 \cdot H$, hydruret of acetyl.

In the next best known hydro-carbon, namely, benzine, there is no more reason for believing in the existence of the monobasic radical phenyl $C_6 H_5$, than there is for believing in the bibasic and tribasic radicals $C_6 H_4$ and $C_6 H_3$, respectively, as seen in the following table:—($X = NO_2$ $Ad = NH_2$).

$C_6 H_5 \cdot H$	$C_6 H_4 \cdot H_2$	$C_6 H_3 \cdot H_3$
$C_6 H_5 \cdot Cl$	$C_6 H_4 \cdot Ad_2$	$C_6 H_3 \cdot Cl_3$
$C_6 H_5 \cdot Br$	$C_6 H_4 \cdot X_2$	$C_6 H_3 \cdot Br_3$
$C_6 H_5 \cdot Ad$	$C_6 H_4 \cdot X \, Ad$	$C_6 H_3 \cdot Ad_2 \, X$
$C_6 H_5 \cdot X$	$C_6 H_4 \cdot Cl \, Ad$	$C_6 H_3 \cdot X_2 \, Ad$
	$C_6 H_4 \cdot Br \, Ad$, &c.	$C_6 H_3 \cdot X_2 \, Cl$, &c.

Lastly, Williamson's othyl theory, although it possesses a great degree of generality, and is supported by most complete analogies both in mineral and in organic chemistry, is only one of many ways of indicating the mutual relations of bodies. It must not be taken as the sole veritable representation of the constitution of the compounds to which it applies. There are no greater proofs of the pre-existence of othyl in acetic acid, than there are of the pre-existence of peroxide of hydrogen in water.

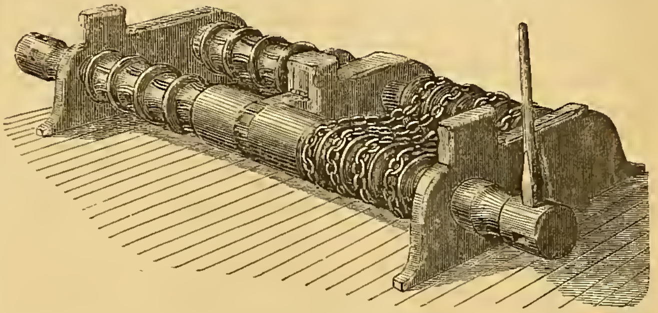
For example, the correlations of benzamide, benzonitryl, hydro-benzamide, and dibenzoylimide, are entirely neglected in the othyl theory. These bodies belong to one single class; they all contain certain benzoic elements, and certain ammoniacal elements; by the absorption of water they yield ammonia, and benzoic acid or aldehyd. But the othyl theory bears no reference to this point of view; it separates benzamide widely from its congeners. Thus we are told that the first body contains the compound radicals benzoyl (analogous to othyl) and amidogen; the second, the compound radicals phenyl and cyanogen; the third, nitrogen and the compound radical benzyl (analogous to acetyl), whilst, with regard to the fourth, as to many other bodies, the compound radical theory fails altogether.

In the three best known hydro-carbons, coal gas, olefiant gas, and benzine, as in many other bodies ordinarily represented as containing compound radicals, the conception of self-existent constituent compound radicals is not only unnecessary but irrational. The particular groupings of atoms, which we denominate compound radicals, do not have an existence apart from the other constituents of the bodies into which they are said to enter.

MONTHLY NOTES.

PROTECTION OF INVENTIONS SENT TO THE PARIS EXHIBITION.—The French legislative corps have just passed a law regarding the protection to be extended to inventions sent to the forthcoming Exhibition, and as to the manner of obtaining such protection. The law contains the three following articles:—"1st. Every Frenchman or foreigner who is the author either of an invention, which is patentable in the terms of the law of the 5th July, 1844, or of a design, which is registrable in the terms of the law of 18th March, 1806, if his invention or design is admitted to the Universal Exhibition, may obtain a descriptive certificate of the article deposited, from the Imperial Commission of the Exhibition. Application for such certificate must be made, at the latest, during the first month subsequent to the opening of the Exhibition. 2d. This certificate confers the same privileges as a patent dating from the date of acceptance of the object exhibited by the local committee, and extending to the 1st May, 1856, notwithstanding that such acceptance by the committee may have been anterior to the date of the present law, and without prejudice to any patent which the exhibitor may take out before the said 1st May, 1856. 3d. Application for certificates must be accompanied by an exact description of the object to be protected, and, if necessary, by a drawing of the same. The applications, as well as the decisions as to them of the Commission, will be entered upon a special record, which will ultimately be deposited with the minister of agriculture, commerce, and public works. The certificate is gratuitous."

DUPLEX AND SCREW-GUIDE SHIP'S WINDLASSES.—Messrs. Richards and Winsor, of Boston, have recently obtained patents in the United States and in England, for two improved arrangements of ship's windlass, one of which is represented in perspective in our engraving. This is the "duplex" windlass, and the novelty in it consists in employing two windlass barrels, instead of only one as ordinarily used. Each coil of the chain cable is passed round both barrels, by which means the strain is distributed over both, whilst each link of the cable gradually finds its way in a species of zig-zag course from the centres to the outer ends of the barrels, without the fleeting, surging or fouling common to ordinary windlasses. Ratchets and palls may be applied to both windlass barrels. A further improvement consists in fitting the barrels with flanges, to keep the several coils or convolutions of the cable in their proper places, and with whelps crossing the spaces between the flanges to give the cable a better hold on the barrel. In the "screw-guide" windlass a simple barrel is used, and this barrel is encircled by a guide frame, consisting of a deep screw or helical flange, which is fixed by its outer edges to cross bars bolted to the bits of the windlass. The inside edge of the screw flange is just clear of the barrel, and the coils of the chain cable lie between the several convolutions of the flange. The cable enters near the centre of the barrel, and as the barrel rotates, the coils of the cable are brought against the screw-guide flange, and are thereby gradually shifted towards the outer end of the barrel, where the cable is payed out on the deck in the usual manner. Iron ridges or whelps are fixed upon the barrel, and wind spirally round it at right angles to the helical path between the guide flanges, thereby giving the barrel a greater hold upon the cable, and at the same time facilitating the shifting of the latter along the barrel as it is wound. In other respects, the two windlasses are constructed according to the ordinary systems.



MAYNARD'S COMBINED THRASHING AND DRESSING MACHINE.—A new agricultural machine, contrived for effecting the better separation of the chaff and cavings from grain and straw as thrashed, has lately been introduced by Mr. R. Maynard, of Whittlesford, Cambridge. The plan which Mr. Maynard has followed out in his new design, has been copied from that in common use by every hand-tasker, who, when he wishes to make up his corn so as to produce chaff fit for the chaff-house, fills his riddle from the rough heap, and, after a few shakes, returns and sifts out the remaining corn on the same heap, instead of continuing the process till the corn is clean sifted out: by this method the roughest is re-sifted, and the chaff left in the corn is free from cavings. This is precisely the principle embodied in Maynard's machine, in which, instead of sifting quite down, as is done in most machines, only the first produce of the riddles is subjected to the dressing blast, while the remainder is continually being returned and mixed with the fresh proceeds of the drum, and the result is a separation of the chaff as perfect as is generally obtained from hand-sifting. This machine also prevents a waste of corn with the chaff, by returning the tail, or that portion which is blown out with, and falls short of, the chaff, and submitting it to a repetition of the process: by this means the whole operation of dressing is done without permitting any portion of the corn to fall on the ground, and it is finally delivered by self-acting apparatus into sacks. The machine is peculiarly smooth in its action—this result being obtained by springs, and by making the two riddles balance each other. Mr. Samuel Jonas, the well-known Cambridgeshire agriculturist, has adopted the new machine, and speaks highly of its work.

PROTECTION OF THE WESTMINSTER PALACE FROM LIGHTNING.—The Parliamentary estimates for the year contain a charge of £2314 for securing the new houses of Parliament from lightning, backed by a very able report on the subject by Sir W. Snow Harris. That great authority on this important subject very clearly and properly exposes the popular error of attributing an attractive power to lightning-rods. It is proved by a most extensive induction of facts, and a large generalization in the application of metallic conductors, that metallic substances have not exclusively in themselves any more attractive influence for the agency of lightning than other kinds of common matter; but that, on the contrary, by confining and restraining the electrical discharge within a very narrow limit, the application of a small rod, or wire of metal, to a given portion of a building, is in reality highly objectionable. Besides, the application of an ordinary lightning-

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rod is of a very partial character. It has small electrical capacity, and is very often knocked to pieces by heavy discharges of lightning. Last June, Ealing church was struck by lightning; the small conductor attached to the tower was partially fused, and damage ensued. So again, in July, a church at Astbury was struck, and the small conductor fused in several places, the discharge dividing on the body of the church, and displacing and shivering several stones. In Her Majesty's navy, conductors of this description have been repeatedly knocked in pieces by lightning.

To secure such a building as the New Palace at Westminster against lightning, Sir Snow Harris considers it requisite to complete the general conductibility of the whole mass, and so bring it into that passive or non-resisting state which it would assume in respect of the electrical discharge, supposing the whole were a complete mass of metal. By this means a discharge of lightning, in striking upon any given point of the building, would have, through the instrumentality of capacious electrical conductors, unlimited room for expansion upon the surface of the earth in all directions, to which, by a law of nature, the discharge is determined. In fact, what is called lightning is the evidence of some occult power of nature, forcing a path through substances which offer greater or less resistance to its progress; such, among the former, as atmospheric air, vitreous and resinous bodies, dry vegetable substances, and such like. In the case of such bodies, a powerful evolution of light and heat attends its course, together with irresistible expansive and disruptive force, by which the most solid and compact structures are rent asunder; whereas, in finding a path through substances which offer comparatively little resistance to its course, this explosive form of action, which we call lightning, becomes transformed into a harmless and unseen current. Hence the great protective influence of a capacious and general system of conduction, such as that just adverted to, which does not restrict the discharge to a given partial and narrow path, but is so circumstanced that lightning, striking anywhere upon buildings, cannot enter upon any circuit, of which the large capacious lines of conduction do not form a part.

Such are the views and principles on which Sir Snow Harris ventures to recommend his system of metallic conductors, to be applied and carried out in the great mass of the buildings constituting the New Palace at Westminster, and which he feels assured will effectually secure those buildings from the effects of lightning, both for the present and for all future time. Now, the general surface of the roofs of the Palace being iron, coated with zinc, and connected with the earth by iron water-pipes in very many places, fulfils, to a great extent, one of the important conditions of the general conduction required, and thus the large mass of the roofing may be deemed as virtually a portion of the earth's surface, electrically considered. It is only necessary, therefore, to provide for the several portions of the building above the general level of the roofs, and to make up, by capacious conductors of copper, for the comparatively low-conducting power of the roofs and the cast-iron pipes which connect them with the earth. The elegant central tower, for instance, is 150 feet above the general level of the roofs of the Palace; and Sir Snow Harris recommends that a capacious conductor of copper tube, of two inches in diameter, and at least one-eighth of an inch thick, be fixed within the upper part of the tower, in its south-west angle, from the large copper terminal which surmounts it to the level of the roofs of the buildings generally; that this tubing should be effectually secured at the joints over solid screw plugs and coupling pieces, and secured to the masonry by metallic staples. At the junction of the tower with the roofs, it is recommended that this copper tubing, after being well connected with the metals of the roof, be continued externally to the earth in as straight a course as possible, and there terminated by one or two projecting branches of solid copper rod. The reason assigned for continuing the copper conductor as a whole into the earth (the soil of which should consist of carbonized matter as far as possible), instead of terminating it in the metals of the roof, is this—that the electrical discharge would have a line of the same conducting material throughout, and not have to leave a high for a lower conducting power. Throughout the entire height of the Victoria and Clock Towers (300 feet from the ground), it is recommended that a copper band of conduction, similar to the conductors applied in Her Majesty's navy, five inches wide and 3-16ths of an inch thick, be fixed and secured to the walls; the band to be properly connected with the metal bodies of the roofs generally, and also with the metal rail of the staircase within each tower. The north and south towers in the centre portion of the river front will also require special protection, by attaching bands of sheet copper from the vanes to the roofing beneath, and from these conductors constructing an independent line of the same metal, to be continued to the earth. The north and south wing towers of the river front should be treated similarly. In the ventilating shaft of the House of Commons, where a coke fire is generally in operation, it is recommended that a tubular conductor should be fixed on the east side of the shaft, and connected with the metals of the roof, as, otherwise, the ascending rarefied column of warm air might determine the course of a stroke of lightning in the direction of the shaft. Lastly, the ornamental turrets and pinnacles of St. Stephen's Porch should be protected by small bands of sheet copper, two inches wide, and one-eighth of an inch thick, neatly attached to them, and placed in connection with the metals of the roof below. A curious instance of the deplorable ignorance existing as to matters of this nature, is told in reference to Christchurch, at Doncaster. The spire of that edifice was struck by lightning in 1836. On it a ball of glass was placed, the authorities knowing that glass was a non-conductor, having the idea that in this way they would repel lightning.

Wright's Vice-Jaw Railway Chair.—We last month* alluded to Mr. Wright's vice-jaw fastening for rails, as applied to his continuous cast-iron sleeper or roadway, and now show its application to chairs to be used upon the ordinary wooden sleepers. Fig. 1 of the engravings is a perspective view of a single chair as fitted with the vice-jaw fastening. Fig. 2 is a similar view of a double chair: and fig. 3 is a transverse vertical section of the chair, showing the manner in which the rail is secured. The rail, A, is held between the solid jaw, B, of the chair on one side, and a key, C, on the other side. The jaw, B, of the chair and the inside of the key are made to fit the channel of the rail on each side, and the rail, resting by its bottom flange on the bed of the chair, is thus sustained both laterally and vertically at all points. The key is fitted into the chair with a dovetail, which prevents its being shaken out. It is introduced longitudinally after the rail is put in its place, and is then prevented from moving longitudinally by an L-shaped lock bolt, D, which fits in a recess cut in the back of the key, C, and passing under the rail, through a groove in the bed of the chair, is secured by a nut, E, on the other side, a second nut being passed on to lock the first and prevent its becoming loose. A small snug, F, is cast upon the bottom plate, G, of the chair at the heel of the bolt, D, to prevent this bolt from coming out of its place, even should the nuts, E, be removed. By tightening the lock bolt, D, the key, C, is made to firmly grip the rail, and the chair becomes a compact and solid mass, no concussion of any kind being capable of dislodging any of the fastening details.

Fig. 1.

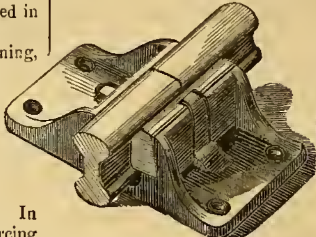


Fig. 2.

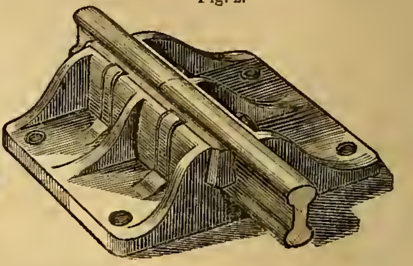
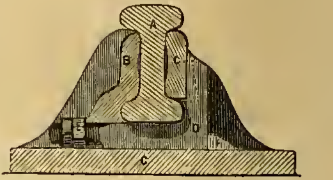


Fig. 3.



Modern Rail Bar Rolling.—Under this head, we last month noted the production, at the Rhymney Iron Works, of a railway bar, 52 feet 6 inches long. Obviously struck with a powerfully emulative feeling, the workmen of the Tredegar Iron Works have gone into the lists, and have turned out a perfect bar of 85 feet 2 inches long. It is of the "Section Maniel," and weighs 75 pounds to the yard, the total weight being 2130 pounds. It is worthy of record, that the workmen gave their services gratuitously in making this rail. Like the former example, it has been sent to the French Exhibition, where it will attract attention, not more from its position as a mechanical wonder, than from the history of its manufacture.

Opposition to Great Inventions and Discoveries.—No true discovery can be long hid by opposition, neither can the successful application of any invention be long retarded by like means. Never was opposition so strong as that which obtained in the sixteenth century; yet that is the century of discoveries in the light of which we now walk, and of inventions the value and utility of which the wide world confesses. Discovery must advance, and inventions will certainly improve and multiply. There is an ocean before us, and we are even now but looking at the shells and pebbles on the shore. There is a mountain above us, and we have climbed but its base. There is an abyss at our feet, and we have examined but its mouth. Immense fields surround us, and we have crossed them but in few paths. And will men be content with this imperfect knowledge? Curious and thirsting for various information, they will try to survey every field, to descend the abyss, to climb the mountain, to cross and recross the ocean. And they must succeed, for God will help them. He wills that his works should be known and understood by man. He wills it as one means by which men shall subdue the earth; and not less as a means of revealing himself. Are not the works of creation so many mirrors and multiplying-glasses in which we see our God? Discovery will go on, and invention also. God has not only given men his own works for their use, but he has endowed them with creative faculties, so that, in filling voids and bringing order from chaos, man imitates his Creator. It is the divine destiny of man to discover and to invent. And opposition, we repeat, is useless. As well may we try to stop the descending avalanche with a straw—to stem the tide of a mighty river with one's hand—to send back the rising ocean with a word—to delay the morning sun with our frown—to arrest the planets in their orbits with our uplifted arm—or to change the order of creation by our mere command. Few objects are more worthy of pity than the opposer of that which is useful and true. He can effect but a modicum of good—he will inflict a large amount of present evil; and, finally, he will appear as one that beateth the air. That we may never be in this position, let us try to learn the great lesson which this subject teaches. There are several lessons we may learn: The deeply-rooted selfishness of mankind; the irresistible progress of men; the germ force of whatever is true and good; but the great lesson of this lecture is *the duty of caution*. Herschel remarks, "The character of a true philosopher is to hope all things not impossible, and to believe all things not unreasonable." This strikes me as one great lesson taught by opposition to discovery and invention. "Impossible" is a word which a wise man will apply very cautiously to the contrivances of men, and to the revelations of the works of God. The impossible of past centuries is now done, and that easily. Time was when wonders were to be found in fables; now they exist in fact. And while the impossible of past times is the possible of the present, the impossible of the present will be the possible of the future. The so-called "unreasonable" of past ages is the common belief of this age; and the "unreasonable" of this age will be the accepted and universal truth of future times. Let us, therefore, be slow in deciding what is unreasonable and impossible, and that which appears to be neither, let us readily hope and believe. —*Rev. Samuel Martin.*

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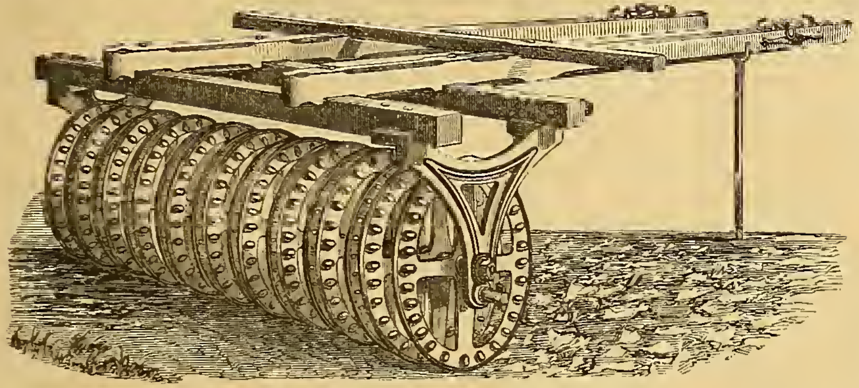
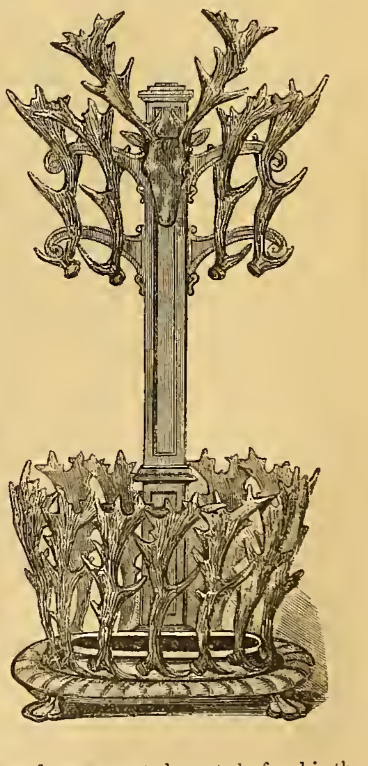
* See page 11, Vol. VIII., Practical Mechanic's Journal.

Patterson's Compound-Action Clod-Crusher.—Now that the farmers are again working up the soil for the coming season, we may refer them to a mechanical help, which acts as a most effective disintegrator of the rude clods. This is the "compound clod-crusher," made by Mr. Patterson of Beverley, noticed in detail in our Part 77, Vol. VII. The annexed figure represents the machine in perspective, as finally modified with its latest improvements. The essential feature brought out in this machine is the use of crushing discs, of equal diameter, arranged to come in contact with the earth in two distinct lines, as regards the forward traverse of the implement. This arrangement gives a most efficient self-cleansing action, as the peripheries of the series of crushing discs are constantly working over each other; at the same time, the intersecting action of the discs, at the part where they touch the earth, greatly improves the pulverizing action. There are twenty discs, thirty inches in diameter, making a six feet six inch roller. The amount of eccentricity is two inches. The upper centre, terminated by a nut, is the line of the eccentric shaft, carrying the working discs. The stud centre beneath is a short axle, riveted on for the travelling wheel, which is shipped on when the crusher is to be transported from one scene of operation to another. The front cross-bar over the shafts is a guard rail, for preventing the backing of the horses upon the discs, the ends of this rail being made to project considerably for the outside horses.



The Dignity of Labour.—The dignity of labour! Consider its achievements! Dismayed by no difficulty, shrinking from no exertion, exhausted by no struggle, ever eager for renewed efforts in its persevering promotion of human happiness, "clamorous Labour knocks with its hundred hands at the golden gate of the morning," obtaining each day, through succeeding centuries, fresh benefactions for the world! Labour clears the forest, and drains the morass, and makes the wilderness rejoice and blossom as the rose. Labour drives the plough, and scatters the seed, and reaps the harvest, and grinds the corn, and converts it into bread, the staff of life. Labour, tending the pastures and sweeping the waters, as well as cultivating the soil, provides with daily sustenance the nine hundred millions of the family of man. Labour gathers the gossamer web of the caterpillar, the cotton from the field, and the fleece from the flock, and weaves it into raiment, soft, and warm, and beautiful—the purple robe of the prince and the gray gown of the peasant being alike its handiwork. Labour moulds the brick, and splits the slate, and quarries the stone, and shapes the column, and rears, not only the humble cottage, but the gorgeous palace, and the tapering spire, and the stately dome. Labour, diving deep into the solid earth, brings up its long-hidden stores of coal, to feed ten thousand furnaces, and in millions of habitations to defy the winter's cold. Labour explores the rich veins of deeply-buried rocks, extracting the gold, the silver, the copper, and the tin. Labour smelts the iron, and moulds it into a thousand shapes for use and ornament, from the massive pillar to the tiniest needle—from the ponderous anchor to the wire-gauze—from the mighty fly-wheel of the steam-engine to the polished purse-ring or the glittering bead. Labour hews down the gnarled oak, and shapes the timber, and builds the ship, and guides it over the deep, plunging through the billows, and wrestling with the tempest, to bear to our shores the produce of every clime. Labour brings us Indian rice and American cotton: African ivory and Greenland oil; fruits from the sunny South, and furs from the frozen North; tea from the East, and sugar from the West; carrying in exchange to every land the products of British industry and British skill. Labour, by the universally-spread ramifications of trade, distributes its own treasures from country to country, from city to city, from house to house, conveying to the doors of all the necessaries and luxuries of life; and by the pulsations of an untrammelled commerce, maintaining healthy life in the great social system. Labour, fusing opaque particles of rock, produces transparent glass, which it moulds, and polishes, and combines so wondrously, that sight is restored to the blind; while worlds, before invisible from distance, are brought so near as to be weighed and measured with an unerring exactness; and atoms, which had escaped all detection from minuteness, reveal a world of wonder and beauty in themselves. Labour, possessing a secret far more important than the philosopher's stone, transmutes the most worthless substances into the most precious; and, placing in the crucible of its potent chemistry the putrid refuse of the sea and land, extracts fragrant essences, and healing medicines, and materials of priceless importance in the arts. Labour, laughing at difficulties, spans majestic rivers, carries viaducts over marshy swamps, suspends aerial bridges above deep ravines, pierces the solid mountain with its dark undeviating tunnel, blasting rocks and filling hollows; and while linking together with its iron but loving grasp all nations of the earth, verifying, in a literal sense, the ancient prophecy—"Every valley shall be exalted, and every mountain and hill shall be brought low." Labour draws forth its delicate iron thread, and, stretching it from city to city, from province to province, through mountains and beneath the sea, realises more than fancy ever fabled, while it constructs a chariot on which speech may outstrip the wind, compete with the lightning, and fly as rapidly as thought itself. Labour seizes the thoughts of genius, the discoveries of science, the admonitions of piety, and, with its magic types impressing the vacant page, renders it pregnant with life and power, perpetuating truth to distant ages, and diffusing it to all mankind. Labour sits enthroned in palaces of crystal, whose high-arched roofs proudly sparkle in the sunshine which delighteth to honour it, and whose ample courts are crowded with the trophies of its victories in every country and in every age. Labour, a mighty magician, walks forth into a region uninhabited and waste; he looks earnestly at the scene, so quiet in its desolation; then, waving his wonder-working wand, those dreary valleys smile with golden harvests; those barren mountain slopes are clothed with foliage; the furnace blazes; the anvil rings; the busy wheels whirl round; the town appears; the mart of commerce, the hall of science, the temple of religion, rear high their lofty fronts; a forest of masts, gay with varied pennons, rises from the harbour; the quays are crowded with commercial spoils—the peaceful spoils which enrich both him who receives and him who yields; representatives of far-off regions make it their resort; Science enlists the elements of earth and heaven in its service; Art, awaking, clothes its strength with beauty; Literature, new born, redoubles and perpetuates its praise; Civilization smiles; Liberty is glad; Humanity rejoices; Piety exults,—for the voice of Industry and gladness is heard on every hand. And who, contemplating such achievements, will deny that there is dignity in labour?—*Rev. Newman Hall.*

Blenheim Buck-Horn Hall Stand.—The ducal forests of Blenheim have lately been laid under contribution for the adornment of residences, in a very novel and ingenious manner, as indicated in our illustrative figure of a "Hat, Coat, and Umbrella Stand." This very elegant piece of hall furniture is the production of Mr. John Parker, of Woodstock, who has very appropriately combined the rich dark oak of Blenheim park with the antlered heads of its noble denizens, so as to produce a beautiful piece of hall or corridor furniture. Mr. Parker has executed these articles under several forms, but the one which we have here engraved is the most elaborate of the series. It consists of a bottom-stand of oak, carrying a circle of buck's horns, which answer as the retaining holders for umbrellas and sticks. This is the base for a central ornamental pillar of oak, surmounted by a stuffed buck's head with its antlers, and additional antlers lower down, as pegs for hats. In another form, the central pillar is a twisted pole, with a pair of horns at the top; whilst a third modification is an umbrella stand only, being a base piece with a ring of horns and no centre. The stand from which our sketch has been made is 7 feet high to the tops of the horns, and the base ring of antlers is 2 feet 8 inches in diameter. Although we cannot convey more than a faint idea of the natural beauty of the materials which Mr. Parker has employed, our readers will yet be enabled to see that the finished production possesses features of elegance and fitness of purpose, not always to be found in the decorator's novelties.



Du Trembley's Combined Vapour Engine.—The system of motive power, engines, originated by M. Du Trembley, a French engineer—who uses steam and ether, working in concert—has now been brought before the public under the auspices of a company. The plan has frequently undergone discussion, more particularly after its practical application to marine purposes. The first really practical application of this patent to steam navigation took place about two years since, when, in June, 1853, the auxiliary screw-steamer *Du Trembley*, of 60 horse power, made her first voyage from Marseilles to Algiers. She had on board a scientific commission, appointed by the French Government, who were satisfied with her performance. Since then she has continued to ply as a regular trader; and some few months after she commenced running, she was visited by Mr. George Rennie, who made the voyage from Marseilles to Algiers and back in her, in most tempestuous weather; and thus had an opportunity of seeing her thoroughly tested. He reported favourably of her performance. A few weeks since, she also was chartered by the French Government for Constantinople, where she now is. This vessel is the property of Messrs. Arnaud Touache, Brothers, who manage a steam-boat company trading between France and Brazil; and so satisfied were they with the performance of the *Du Trembley*, after many months' experience, that they decided on altering the engines of two new vessels for this company from the ordinary construction, on which they had been commenced, to the combined vapour system. These vessels are *La France* and *Le Bresil*, a sister ship in every respect. They are of a size which takes them entirely out of the class of experimental vessels; that is to say, they are 224 feet in length and 36 feet beam, and are fitted with engines on Du Trembley's plan, made by the English house of Taylor & Co. of Marseilles, and of the nominal power of 300 horses. *La France* left Marseilles for Kamiesch on the 13th of January in this year. The *Bresil* is now finished, has been tried and approved by the French Government, and is now loading for them at Marseilles. Since the return of *La France*, Messrs. Arnaud Touache, Brothers, have ordered the construction of three larger vessels, and have entered into a contract with the proprietors of the patent for the exclusive privilege of the French Mediterranean trade, for which they have considered it worth while to pay a heavy sum. Another company, established under the title of the French American Company, for the direct navigation from France to the United States, have had constructed, at Nantes, the first two vessels for their line, one of which, *Le Jacquart*, was launched on the 18th November last. She is of iron, and 242 feet in length. The combined vapour engines for these vessels are in a very forward state, at the manufactory of M. Cavé, at Paris, and are 500 horse power each.

The Great Crane at Glasgow—New Shears at Southampton.—The Glasgow River Trust has just put up, at the lower end of the harbour, a new crane, which takes rank as first in the world. The contractors and constructors are Messrs. J. & G. Thomson, Clyde Bank Foundry, Glasgow, under the superintendence of Mr. J. F. Ure, the engineer of the Trust. It is erected upon a solid square foundation, which rises 11 feet above the surface of the quay, 21 feet above high water, and 29 feet above low water-mark. This seat, which is 30 feet square, is built of solid freestone blocks. The machine is worked with double gearing, winding the chain on two sets of barrels, which are so placed as to act as a back balance to the weight upon the jib. This jib consists of two wrought-iron tubes, 53 feet in length, and mounted with four plies of $1\frac{5}{8}$ inch chain, for the support of the weights. The point of the jib rises 62 feet above high water and 71 feet above low water-mark—thus making provision for supplying machinery to, or elevating machinery from, the loftiest ships which have ever floated. The crane swings the weight 33 feet clear of the quay wall. When tested, it lifted, with the greatest ease, 60 tons of timber in logs, which had been previously weighed in detail. Its chain has been tested to 200 tons. The crane seat was built by Mr. York, the builder of the New Victoria Bridge at Glasgow, and is a very excellent piece of work. It has been stated that this is the first large crane connected with this or any other harbour, which, upon completion, has stood the test without breaking. Most, if not all, the existing large cranes have, upon being first tested, given way to a greater or less extent, and have had to be reconstructed or repaired before they could be used. Some of them, indeed, have broken down two or three times in succession before they could be applied to any useful purpose; and, in consequence, they are in operation possessed of much less power than they were originally intended to have. In Greenock there is a great crane, nominally of the capacity of 70 tons, but practically it does not work up to this weight. Moreover, it takes between three and four hours to turn fully upon its seat, whereas the Glasgow crane has been "slued" with its load completely round in nine minutes; when light, the crane can be turned a complete round, by one man, in four minutes; and it is capable of lifting a weight of 60 tons off the quay, and depositing it in the hold of a vessel in twenty minutes. The brake is so powerful that one man can, with the greatest ease, lower 60 tons by its means alone. The cost of the crane is upwards of £8000. In Liverpool they use a mighty travelling carriage, containing machinery, which fulfils the duties of a crane capable of lifting 60 tons; but the apparatus is necessarily constructed on such a large scale, that it would fully occupy the breadth of the Broomielaw at the widest part. In most of the other ports in the kingdom, the only method of putting heavy machinery on board steam-ships is by means of shears erected for the special purpose. New shears have just been erected at Southampton to carry 50 tons. They consist of three immense sticks of yellow pine, the two front legs being 88 feet long and 32 inches in diameter, strengthened by iron hoops placed at a distance of nine feet from each other. The back leg measures 102 feet in length, and 33 inches in diameter, and is strengthened at the top by what are called "fishing pieces," so as to make it uniform throughout. Each of the sticks or legs is the production of a single tree. The plan of these shears differs materially from that usually adopted, inasmuch as a weight can be lifted from a vessel 30 feet from the dock wall and deposited on the quay, whereas ordinary shears are only capable of lifting great weights without being able to carry them ashore. This additional facility is afforded by the third leg, which, forming a triangle, is made to traverse in and out from the dock quay. The machinery connected can be worked either by hand or steam, a small steam-engine and house having been erected adjacent to the position of the shears. This great addition to the port was designed and executed by the firm of Seaward & Capel, the timber-work being intrusted to Messrs. Ferguson of Millwall, and the whole placed under the superintendence of Mr. A. Giles, the Dock Company's engineer.

The Kensington-Water Works in America.—These works, commenced in the year 1849, under the superintendence of Mr. J. Singerly, were intended to supply the inhabitants of the district of Kensington with water from the river Delaware. The engine and pump-house is situated on the river, at the foot of Wood Street, in the northern part of the district. It is fifty feet wide by seventy feet long; built of bricks in a neat, substantial manner, with rustic work at the angles; the foundation walls are based upon a solid rock, that lies about eighteen feet below the surface of the ground. The two reservoirs are situated between Sixth and Seventh Streets, and north of Lehigh Avenue, at a distance, measured on the line of the ascending main, of about thirteen thousand three hundred feet from the pump-house, and at an elevation of one hundred and twenty feet above the level of mean tide. The bottoms and sides are covered in the usual manner, with bricks set on a bed of well-rammed clay puddle. Each reservoir is, on the bottom, one hundred and sixty-one feet wide by two hundred and ninety-six feet nine inches long. The angle of inner slope, 35° from a vertical line. The content of each, when filled to a height of twelve feet above the bottom, is 4,642,026 standard gallons, or about 100 gallons for each inhabitant of the district. There are two pumps and engines, with two sets of boilers, so arranged that either engine can be supplied with steam from either set. Engine and pump, No. 1, was built by Messrs. Brock and Andrews, to designs made from the specifications furnished them by the committee, appointed by the commissioners of the district from their body to superintend, in conjunction with their engineer, the construction of the works. The engine is non-condensing, with a cylinder 30 inches diameter, 6 feet stroke, lying in a horizontal position, and fitted with balance puppet valves. The boilers built for this engine are six in number, 42 inches diameter, and 40 feet long; and supply steam of 40 pounds pressure per square inch, for ten revolutions of the engine per minute. The pump barrel is 18 inches diameter, 6 feet stroke, and lies in a horizontal position, about eighteen feet below the steam cylinder, and eight feet below mean tide. It is double acting, with valve boxes similar to those in use at Fairmount Water-Works, originally designed by the late Frederick Graff, C.E. Motion is given to the pump piston by the vibrations of a vertical lever beam, whose upper and lower ends are respectively attached by links to the cross-head of the cylinder and that of the pump. The specifications required: "Two receiving and two discharging valves, which will be placed at an angle of 45°; each set will be divided into four divisions, and of equal or larger capacity than the area of the pump barrel." This condition compelled the valve boxes to be made unusually large. Their dimensions were three feet ten inches wide, two feet ten inches deep, and nine feet long. Thickness of metal, one and three-quarter inches. So much flat surface was presented to the pressure of the water, with an insufficiency of metal to resist it, that the boxes bursted soon after being put in operation, of course disabling the whole works. A committee of consulting engineers, after inspection, advised several important alterations and additions to the pumping apparatus and engine, which were made under the superintendence of William E. Morris, C.E. The banks of the reservoir showed symptoms of weakness, and were strengthened in the necessary parts. The subsequent action of the engine has abundantly proved that the changes and additions were judicious and necessary. The consumption of fuel required to keep engine No. 1 supplied with steam is not positively known, as there have been no conveniences at hand for testing it; but it is stated by Mr. J. J. Dehaven, chief engineer, in his official report to the commissioners of the district, to be eleven tons in twenty-four hours, when engine averages ten double strokes per minute, carrying steam for the whole stroke, which shows the evaporative efficiency of the boilers to be 4·24 pounds of water (first warmed by passing through a heater, forming part of the exhaust pipe of engine), converted into steam of 40 pounds pressure, by the consumption of one pound of anthracite coal. No convenient opportunity has offered for proving the amount of water pumped into the basins by engine No. 1 in a given time, but by taking the result of the trial made on engine No. 2, which gives the amount of water raised, 70·6 per cent. of the space displacement of piston, making, at ten strokes per minute, a total of 1,550,442 standard gallons raised in twenty-four hours, by an expenditure of eleven tons of coal, or about 62·9 gallons, or 522 pounds of water, raised 112 feet high, at a velocity of 120 feet per minute for each pound of coal consumed. Engine No. 2 was built by Messrs. Reaney, Neaffie, & Co., and put in operation in August, 1852. It is of the condensing type, and has a cylinder 42 inches diameter, 6 feet stroke, standing in a vertical position. It is fitted with balance puppet valves. The steam is cut off after the piston has travelled seven-eighths of its stroke. The piston-rod passes through the top and bottom of the cylinder; its upper end is attached to a lever beam, which gives motion to a shaft for working the valve gear, and carrying a fly-wheel of just sufficient weight to make the engine pass the centres without hesitation. The lower end of the piston-rod is attached to the horizontal arm of a right-angled bell crank, whose vertical arm is connected to the pump piston-rod. The pumping apparatus is the same as that of No. 1, except the pump barrel, which is $19\frac{7}{16}$ inches diameter, or one inch seven-sixteenths larger. Both sets of pumping apparatus have upon their discharging pipes an air vessel whose content is 230 cubic feet; there is also one upon the supply pipe, containing 30 cubic feet. In the absence of experiment in this case, it cannot be determined whether the latter vessels are of use or not. The experiment of Messrs. Kirchweger & Prussman show that, at high speeds of pump piston, the application of an air vessel to the supply pipe of a pump is of positive benefit; but in this case, the speed of the piston is not high, averaging 144 feet per minute; the supply pipe is more than one-half larger in diameter than the pump barrel; the pump is about eight feet below mean tide, which head is sufficient, after a liberal allowance has been made for friction in the pipe, to fill the vacuum made by the pump piston, when moving at a higher rate of speed than obtains in ordinary times. These advantages tend to show that the air vessels on the supply pipes might be dispensed with without prejudice, and, again, the coefficient of effect is not greater than where such an air vessel is not used. In September, 1852, one of the reservoirs having been emptied, the Watering Committee instructed the engineer to fill it with pump and engine No. 2, and keep an account of the time occupied in raising the surface of the water twelve feet above the bottom, when the content is, as previously stated, 4,642,026 gallons. The evaporation from such a large surface of water, and the absorption by the brick lining of the basin, would be probably compensated for by dews and rain; but as no account of the weather was kept, extreme accuracy not being required, the amount of water raised may be considered as neither increased nor diminished by incidental causes. The time occupied in filling was 60 hours; number of double strokes, marked by a register, 36,900. This gives for each double stroke nearly 126 gallons. The space displacement of piston is nearly 178·5 gallons; the actual effect of the pump is, therefore, not quite 70·6 per cent. of its capacity, or about the usual per centage. No account was kept of the consumption of fuel, but, from the official report of the engineer for the month of November, 1853, is taken the following account of the consumption of coal, running time, number of revolutions, and amount of water pumped into the basin by No. 2.

Total tons of coal consumed,	120
Number of hours' running time, including stoppages for oiling, cleaning, &c., 528, or	22 days
Total revolutions,	389,919
Total gallons pumped into basin, estimating the quantity raised each double stroke at 126 gallons, as determined by the trial in September, 1852,	49,129,794

This gives, as the actual effect realized by the expenditure of one pound of coal, 182·77 standard gallons, or 1526 pounds of water raised 112 feet high, with a velocity of 164·5 feet per minute. The evaporative efficiency of the boiler is about the same as in other boilers of its type, 'flue and rising return flue,' 8·75 pounds of water evaporated by one pound of coal; the feed water being supplied from the hot well of the engine. When No. 2 performs the same work, with steam of ten pounds supplied by the cylinder boilers, there is required a consumption of eight tons of coal, which gives 5·98 pounds of water evaporated by one pound of coal: an increased effect which must be attributed to the slower and more perfect combustion of the fuel, as the fires need not be urged, but the contrary, when steam of but ten pounds is required. Engine No. 2 has been kept running at a speed of eighteen revolutions per minute, when the consumption of water from the basin has been so much greater than ordinary as to require it. At that speed the valves do not jar much more than when making twelve beats per minute, which is attributed to their construction, the part farthest from the hinge being made very heavy, to insure prompt closing before the return stroke of the pump piston permits the reflux of the water to close the valve with a blow; and to the very large size of the air vessel on the ascending main, its content being thirty-four cubic feet (or nearly three times the capacity of the air pump barrel) of air, at a density due to the pressure resulting from the effort of the column of water in the main when moving at that velocity. The pressure, as determined by one of Bourdon's guages attached to the main, per square inch of pump piston, when moving at different velocities, varies from the commencement of stroke to half stroke,—

63 to 68 pounds at a speed of 120 feet per minute,
70 to 75 " " 156 " "
77 to 80 " " 168 " "

with 11 feet 3 inches of water in the basins. The speed of the water in main being inversely as the diameters of the pump and main, will be 16¼ per cent. greater than the speed of that in the pump. When at the speed of 156 feet per minute, which is greater than that intended for ordinary service, the throttle-valve was partially closed, effecting a reduction of, say 1·5 pounds below the boiler pressure of 10 pounds, making the initial cylinder pressure 8·5 pounds, which is farther reduced by expanding one-eighth to a mean pressure of 8·4 pounds. Vacuum steam by guage, 13 pounds; total pressure per square inch in cylinder $=$ 21·4 pounds. The pressure per square inch on cylinder piston necessary to keep the pump piston at the above speed is $\frac{72·5 \times 19·4375^2}{42^2} = 15·49$; subtracting this from 21·4, there remains 5·91 pounds, which is absorbed by the friction of the pump and engine and the load on the air pump. The pressure per square inch on pump piston due to the head of water, $120 - 8 = 112$ feet, is nearly 48·5 pounds; average pressure at 156 feet per minute, 72·5 pounds; difference 24 pounds; equivalent to an additional head of nearly 55·5 feet, or almost one-half more than the actual height to which the water is raised. This proves that about one-third of the effective engine power is used in overcoming the friction and inertia of the water column—a loss that is occasioned by its devious course, two right-angled bends, in addition to those of a small angle, caused by the inequalities of the ground through which the main is laid, at a uniform depth below the surface, occurring in the passage to the basins, and by its great length, over two and a half miles. During the very warm weather of July last, one pump would not raise enough water to supply the increased demand, unless the speed of the engines was made greater than that considered prudent, and for which they were designed, twelve double strokes per minute. To meet the demand, both engines were set to work, each averaging ten revolutions per minute, which speed was found adequate to keep up the supply. Both pumps discharged into one ascending main of 18 inches diameter, which bore the increased pressure due to the increased velocity of the water, proving it to be of sufficient strength for the ordinary strain to which it is subjected.

The Boyne Railway Viaduct at Drogheda.—The great viaduct over the Boyne river at Drogheda, on the Dublin and Belfast Railway, which most railway travellers in Ireland must have noticed as a most magnificent work, is a third of a mile long. It is composed of twelve arches of blue limestone, of 61 feet span each, on the south bank, and of three similar arches on the north bank, resting on slender piers, the tideway being crossed by three lattice beams, a centre span of 264 feet, and two side spans of 138 feet 8 inches each, in the clear, at a height of 90 feet above high-water of spring tides. These lattice girders, forming a continuous beam throughout their entire and combined length, are 22 feet 6 inches deep, the intersections of the lattice bars at an angle of 45° forming squares of 7 feet 5 inches diagonally. The tension bars in the lattice are severally proportioned to the strain to which they are liable, whilst those which act as struts are in themselves lattice beams, made after the experience derived from a series of trials on the compressive force that might safely be applied. The sectional area of the piles of plates forming the top and bottom webs of the centre span is 113·5 inches at the centre of the top, and 127 inches in the bottom;—over the piers towards the side spans it is 132·6 inches on the top, and 127 inches in the bottom;—at the point of inflection, 45 feet from the piers towards the centre, the area, both in the top and in the bottom, is only 68·5 inches, and in the side spans the areas diminish to 41·3 inches at 80 feet from the piers, continuing thence with a uniform area to the abutments. The roadway is 24 feet 6 inches wide, supported by transverse lattice beams, laid at the level of the under side of the main beams, and formed of Memel planking 6 inches thick, carrying two lines of rails, a third temporary line being laid for the purposes of testing. The side spans were first tried, by loading them, simultaneously, with three trains of loaded waggons, weighing 280 tons on each span, or two tons on each running foot; under this load the greatest deflection was seven-tenths of an inch, whilst the middle of the centre span rose half an inch. One of the side spans was then cleared, the other retaining its imposed weight; and the centre span was loaded with 540 tons—rather more than two tons per running foot; in this condition the deflection of the loaded side span was three-tenths of an inch, and that of the centre span was nearly $1\frac{7}{10}$ths inch, whilst the unloaded side beam rose about three-tenths of an inch. On the other side beam being also unloaded—the weight of 540 tons still remaining on the centre beam—the deflection increased to $1\frac{9}{10}$ths inch, and both the side spans rose about three-tenths of an inch above their normal level. When all the three spans were loaded with a weight of 1100 tons—equal to two tons per running foot—the deflection in the centre span was 1½ inch, and that in the side spans was three-tenths of an inch. On the removal of this weight, the permanent set given to the beams was less than one-tenth of an inch.

The three spans have been calculated to bear a pressure of 5,500 tons spread over them, or about five times the weight under which they were tested, whilst the ordinary duty of the bridge can scarcely bring upon it more than 350 tons—less than one-third of the testing weight, and about one-fifteenth of the load that it is calculated to bear. Under a load of 5,500 tons, there will be 15 tons per inch of tensible, and 13½ tons per inch of compressive strain. The weight of wrought-iron in the centre span is 361 tons, and in the two side spans 151 tons each; in the pillars over the piers 76 tons,—total weight, 739 tons of wrought-iron, besides 15 tons of cast-iron in the plates and rollers. The dimensions of the iron-work are such, that the greatest strain, under a maximum load, will not exceed a tension of 5 tons per square inch of sectional area, after deduction of the rivet holes, and less than 4½ tons per inch for compression. The centre span is constructed with a camber of nearly 4 inches, and, on being relieved of its supports, it descended with its own weight only 1⅞ inch, but rose again ⅝th of an inch on the supports of the side spans being removed. In order to demonstrate the accuracy of correspondence between the calculated position of the points of inflexion and the actual situation practically, all the rivets in the top web, above that spot, were cut out, drifts being inserted *seriatim* during the process, and gradually taken out again after marking the edges of the plates. After removing these drifts, the joints were made to close and to open by raising or lowering the side spans, demonstrating clearly that the points of inflection for a uniform load corresponded identically with the calculations previously made. The Boyne Viaduct was opened for railway traffic on the 5th of April, 1855. It was designed by Sir John Macneill, the engineer-in-chief of the line, and was erected entirely under the direction of Mr. Barton, the acting engineer, by whom the calculations for the structure were made, and the design worked out.

Lord Ranelagh's Gunnery Experiments.—Lord Ranelagh, who has lately devoted so much time and careful attention to the improvement of fire-arms, has lately had a grand trial day at Mulgrave House, Fulham. Two breech-loading rifles, the invention of Mr. Sharpe, of Springfield, in America, and of Mr. Leetch, of Margaret Street, Cavendish Square. Lord Ranelagh has assisted Government in every way, by experiments made at Mulgrave House, to provide our troops with more efficient weapons than they at present possess. The result of his lordship's exertions was, that Lord Hardinge and Lord Raglan recommended the Board of Ordnance to make experiments of all breech-loading guns. These experiments went on for two hours at Woolwich, under the superintendence of the sub-committee of small arms. About 17 different inventions were submitted to notice, underwent severe trials with double charges and otherwise, and two guns were ultimately selected by Colonel Hay, Commandant of the School of Musketry at Hythe. Those arms reported upon favourably by Colonel Hay, were Mr. Sharpe's and Mr Leetch's, the former being recommended, we believe, for the cavalry, and the latter for the infantry.

Sharpe's rifle, which is very simple in mechanism, is opened at the breech by the trigger-guard acting as a lever. The cartridge is inserted, and the trouble of tearing it with the teeth is saved by the lever, which, when shutting, cuts it off, thereby exposing the powder directly to the fire of the primer. It primes itself by an arrangement consisting of a simple follower working with the cock, which places the primer upon the nipple, just before the contact of the hammer and nipple. It is charged with from 25 to 50 primers or flat caps, which, detached from their resting-places, are made to meet the hammer as it descends—an arrangement invented by Mr. James Kerr, and nothing can be imagined more perfect than the accuracy with which, by a simple touch, the primer is released. Should this self-priming apparatus be put out of order, which is not very probable, the common cap may be used in the ordinary way. The pattern is the American cavalry weapon; it has a 22-inch barrel, and a range of 600 yards.

Mr. Leetch's fire-arm is very differently constructed, being made to take the present Government cartridge and cap. The chamber opens on the right-hand side of the gun; and, after the cartridge containing the powder and ball is placed in it, is then closed in its place. The ordinary percussion cap is placed on the nipple, and the gun fired in the usual way. This chamber is firmly fixed in its place by an ingenious self-acting locking bolt, which is worked by the action of the cock. It is a three-groove Minié rifle, with a 39-inch barrel, and has a range equal to that of the present Enfield rifle-musket, which is sighted to 1000 yards. The experiments of both these rifles were commenced by firing at a target, three feet in diameter, at a distance of 100 yards. The firing was executed with great precision, and the rapidity of loading and discharging Sharpe's rifle, and the accuracy of its aim, were subjects of universal admiration. Twenty shots were discharged from it in a minute and a half, and all hit the target. Forty rounds—26 of which took effect—were subsequently fired by it in five minutes and four seconds at a piece of wood 14 inches by 8, situated at a distance of about forty yards. The same number of rounds was fired by Leetch's rifle in ten minutes and three seconds—nearly exactly double the time; but Mr. Leetch, having the Government cartridge, was obliged to bite off the end, pour in the powder in the chamber, and reverse the bullet, as is done in the muskets used in the army, and cap the gun in the ordinary way. Both weapons are superior to any other arms of their kind, and possess the merit in common of being fired continuously, of not having their explosive powers affected by immersions in water, and of not undergoing the slightest derangement from rapidity of firing, the pieces requiring neither oiling nor cleaning. Sharpe's has been fired over 150 times without fouling.

An English improvement on the Prussian needle musket, Needham's breech-loading rifle,* was also examined and tested, and proved the merits it was believed to possess in respect both of mechanism and execution. It fired 13 rounds in the minute, and, independently of completely excluding dust, rain, and wet, is subjected to less fouling than the Prussian pattern, from leaving the paper behind after the discharge of the cartridge. The specimen tried was a double-barrel, and if not so suitable for military service purposes as the two other kinds of arms, it stands unrivalled as a fowling-piece. A very favourable opinion was generally expressed of its peculiar merits.

The "London" Locomotive above Niagara.—The great subject of conversation in the West just now, is the passage of the "London" locomotive over the gorge of Niagara, and the name of the great metropolis was never in prouder remembrance than when borne, as now, upon the fabric that testified almost man's highest excellence in bold art. The bridge settled just half an inch when the locomotive was at the centre, for the brave men who controlled the starting bar paused in the very mid-river. Thus arriving at the line where the state and the colony meet, the flags of the two nations were waved, the scarlet and the blue fluttering in the exultation of those who there did homage to the blended sovereignty. The bridge is built so that it rises arch-like in the centre. The deflection was no greater than was anticipated. There are two tracks—indeed, three, on the bridge; the 4·8½ of the New York Central, the 5 feet of the Great Western, and by a fifth rail the New York and Erie (continued by the Canandaigua road) also can transport freight or humanity over. There were six passengers or persons on this boldest of all locomotives, and by a measure of justice seldom wrought out in bold enterprises, all were represented, as well the man who furnished the means as he who produced the skill necessary. There is a good omen in the fact, that the crossing was first done from the Canada side over to the American, and the sons of St. George will feel justified at grouping the two recollections, that, as an English steamer first made regular communication across the sea, it was an English locomotive that has first made this thrilling transit over the Gulf. Far away beneath, so far that the heavy wave scarce shows its swelling, rushed the Niagara, and the shrill shriek of triumph that the "London" sent forth as it passed over the chasm was heard beyond the cataract itself.

The American Paper Manufacture.—There are in the United States 750 paper mills in actual operation, having 3000 engines, and producing in the year 270,000,000 pounds of paper, which is worth, at 10 cents per pound, 27,000,000 dollars. To produce this quantity of paper 405,000,000 pounds of rags are required, 1½ pounds of rags being necessary to make one pound of paper. The value of these rags at 4 cents per pound is 16,200,000 dollars. The cost of labour is 1¾ cent upon each pound of paper manufactured, and is therefore 3,375,000 dollars. The cost of labour and rags united, is 19,575,000 dollars a year. The cost of manufacturing, aside from labour and rags, is 4,050,000 dollars, which makes the total cost 23,625,000 dollars of manufacturing paper, worth 27,000,000 dollars. We import rags for this manufacture from 26 different countries, and the amount in 1853 was 22,766,000 lbs., worth 982,837 dollars. Italy is the greatest source of supply, being more than one-fifth of the whole amount, but the supply has been gradually falling off every year. From England, we imported 2,666,005 pounds in 1853. The cost of imported rags has been as follows:—1850, 3 61-100 cents; 1851, 3 46-100 cents; 1852, 3 42-100 cents; 1853, 3 46-100 cents. The consumption of paper in the United States is equal to that of England and France together.—*Boston Post.*

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded December 18, 1854.

2661. William Gilpin, 2 Moorgate-street, and Abraham Bowen, Stafford-street, Peckham—A new method for the effectual consumption or prevention of smoke, and the more perfect combustion of coals and other fuel, by means of a mechanical apparatus and furnace-bars of a certain construction; a portion of the same may be applied for raising water, and in furnaces where blast is required.

Recorded January 17, 1855.

126. John Slack, Manchester—Improvements in the manufacture of velvets, velveteens cords, and other woven fabrics, in which floated threads or loops are formed for the purpose of being cut.

Recorded February 16.

351. Richard A. Brooman, 166 Fleet-street—Invention of a means of preparing the fibres of certain plants of the bean species, in order to form them into pulp, and to fit them for other manufacturing purposes.—(Communication.)

Recorded February 28.

432. Thomas Helliwell, Grecnhirst Hay, and Joseph Barker, Houghstone Mills, both near Todmorden, Yorkshire—Invention for preserving pickers and picker-sticks, and for preventing cops being knocked off the spindle in the shuttle during the process of weaving in the power-loom.

Recorded March 8.

511. Barthelemy Louis François Xavier Flechelle, Paris—Improvements in flat purses (porte-monaies).
512. Louis E. Bataille, Paris—Improvements in looms for weaving pile fabrics.
513. Gustav C. Reithcimer, Holyhead—Improvements in the means of loading or discharging fire-arms.
514. Thomas Walker, Birmingham—Improvements in rotary engines to be worked by steam or other fluid.
515. Antoine F. J. Claudet, Regent-street—Improvements in stereoscopes.
516. George Hazeldine, Lant-street, Southwark—Improvements in wheel carriages and in the wheels thereof.
517. Alfred Krupp, Essen, Prussia—Certain improvements in the construction of railway wheels.
518. James Brooks and William S. Walter, Bury—Improvements in looms for weaving.
519. John Taylor, Spring-grove, Isleworth—An improvement in packing and preserving eggs and other articles of food.
520. Henry Gilbert, Kensington—Improvements in hurdles.
521. John Aitken, Servetus Aitken, and John Haslem, all of Bacup, Lancashire—Improvements in machines used for preparing, spinning, and doubling cotton, wool, flax, silk, and other fibrous materials.
522. John Norton, Dublin—Improvements in fire-arms and ammunition.
523. William Foster, Black-dike Mills, near Bradford—Improvements in machinery or apparatus for drying wool and other fibrous substances.
524. William Foster, Black-dike Mills, near Bradford—Improvements in machinery or apparatus for cleansing wool and other fibrous materials.
525. Julian Bernard, Club Chambers, Regent-street—Improvements in the manufacture of boots and shoes or other coverings for the feet, and in the machinery or apparatus to be employed therein.
526. John Gerard, Guernsey—Invention of a portable floating pier or bridge, separating into sections, which are designed and adapted for forming floating vessels, also fixed and moveable structures on land, such as sheds and vehicles.

Recorded March 9.

527. George White, 5 Laurence Pountney-lane, Canon-street—Improvements in the treatment of horn and other substances of a similar nature.—(Communication.)
528. Patrick Dall, Woolwich—Improvements in self-acting, indicating, and recording mechanism for steam engines.
529. James Bullough, Accrington, Lancashire—Improvements in looms and apparatus for weaving.
530. James Murdoch, 7 Staple-inn, Holborn—An improved shade or reflector for lamps.—(Communication.)
531. James Murdoch, 7 Staple-inn, Holborn—An improved method of enlarging or reducing designs, maps, and other similar articles, also apparatus or machinery to be employed in the same.—(Communication.)
532. Francis A. Barnett, Nelson-street, Bristol—An improvement in the manufacture of metallic bedsteads and couches for the use of invalids, applicable to bedsteads and couches made from any other material.
533. Thomas Hill, Birches, Stanton Lacey, Salop—Invention of certain machinery or apparatus to be employed in the manufacture of bricks, drain pipes, tiles, and other like articles from plastic materials.
534. Samuel C. Lister, Manningham, near Bradford—Improvements in treating and preparing the fibres of flax and hemp and other fibrous substances for spinning.
535. George T. Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in preparing wool and other fibrous substances for spinning.—(Communication.)
536. Samuel C. Lister, Manningham, near Bradford—An improvement in combing the noil of silk waste.
538. Samuel C. Lister, Manningham, near Bradford—Improvements in machinery for combing wool and other fibres.

Recorded March 10.

540. William Mickle, Willington, Durham—Improvements in the smelting or production of iron from its ore in blast furnaces.
541. Alexander Clark, Gate-street, Lincoln's-inn-fields—Improvements in the construction and manufacture of celestial and terrestrial globes for the study of astronomy and geography.
542. Joseph Sunderland, Marsden, near Burnley, Lancashire—Improvements in self-acting apparatus for controlling or regulating the flow of liquids from casks or other vessels.

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* See page 23, Part 61, *Practical Mechanic's Journal*, for complete engravings of Mr. Needham's gun.

543. John Hughes, Uskside Iron Works, Newport, Monmouth—An improvement in bushing the touch-holes of cannon.
544. Charles Heaven, Hull—Improvements in machinery used for embroidering fabrics.
545. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in machinery for making butt-hinges of wrought-iron or other metal complete at one operation.—(Communication.)
546. Robert Brisco, Low Mill House, St. Bees, and Peter S. Horseman, St. John's Beckermet, Cumberland—Certain improvements in the preparation of flax.

Recorded March 12.

547. Joseph Malcomson and Robert Shaw, Waterford, and William Horn, Mark-lane—Improved expansion valves for steam-engines.
548. David H. Brandon, 11 Beaufort-buildings, Strand—Certain improvements in machinery or apparatus for cutting fustians and other piled fabrics.—(Communication.)
549. John Brookes, Birmingham—A new or improved waistcoat.
550. James Hulls, Plaistow, Essex, and John Lowe, Lambeth-road, Surrey—Improvements in coating iron and other metals with lead.
551. George Mosley, Southwark—An improvement in buttons.
552. John Gilbert, Engine Works, Boston-street, Hackney—An improved pump or pumping apparatus.
553. William P. Stanley, Peterborough—An improvement in or addition to clod crushers.
554. William Score, Bristol—An improvement in bleaching oils, fats, and resin.
555. James M. Napier, York-road, Lambeth—Improvements in the furnaces used in the manufacture of soda or alkali.

Recorded March 13.

556. David Macaire, Paris—Improvements in casks and taps.
559. Thomas W. Willett, 25 Belsize-road, St. John's Wood—Certain improvements in swimming-belts.
560. Samuel Swingle, Aston-juxta-Birmingham, Warwickshire—An improvement or improvements in the manufacture of certain kinds of metallic spoons, forks, and ladles.
561. John Gracie, Stanley-terrace, London-road, Rotherhithe—Invention of implements in wood-planing machines.
562. Alfred V. Newton, 66 Chancery-lane—An improved construction of engine to be actuated by the expansive force of explosive mixtures.—(Communication.)
563. Charles Iliffe, Birmingham—Improvements in the manufacture of metallic rods, bars, and tubes.

Recorded March 14.

564. Richard C. G. Cooke, New Swindon, Wiltshire—Improvements in military and other cloaks.
565. George Riley, 12 Portland-place North, Clapham-road—An improved process for the manufacture of starch or grape sugar.
566. Henry Gray, 60 Clements-lane, Pickett-street, Strand—Invention for manufacturing from vegetable substances a material which can be applied to all adhesive surfaces for either useful or ornamental purposes, as a substitute for, and in the same manner as flock is now used or applied on adhesive surfaces.
567. Benjamin Goodfellow, Hyde, Cheshire—Improvements in regulating the power for driving the pumps of hydraulic presses.
568. Robert Neale, Cincinnati, U.S., and 17 Cornhill—Improvements in copper and other plate printing.
569. John Kidder, Plaistow, Essex—Improvements in the construction of castors.
570. William and John Galloway, Manchester—Certain improvements in balancing or regulating the pressure on the slide valves of steam-engines.
571. Jonas Marland, Sun Vale Iron Works, Walsden, Lancashire—An improvement or improvements in the manufacture of rollers for driving, spinning, doubling, and preparing cotton, wool, flax, and other fibrous materials, a part or the whole of which improvement or improvements are applicable to shaping metals for other purposes.
573. William Soelman, 3 Bennett-street, Fitzroy-square—Improvements in propellers.
574. Edmund J. Mitchell, Bradford—An improvement in rollers employed in the washing of wool and linen, in the squeezing of sized cotton, warps, and other like purposes.
575. Joseph Turner, Farringdon-street—An improvement in coffin furniture.
576. Julian Bernard, Club Chambers, Regent-street—Improvements in the manufacture of boots and shoes, or other coverings for the feet, and in the machinery connected therewith.
577. Charles Goodyear, jun., Paris—Improvements in the plates of artificial teeth.
578. Richard Wright, Richmond—An improvement in the construction of swords.
579. Abraham Davis, Tottenham-court-road—An improved polishing powder.
580. John Hetherington, Manchester, and Archibald Vickers, Bristol—Improvements in machinery for preparing, spinning, and doubling cotton and other fibrous materials.
581. William Lister, Dnnsa Bank, near Richmond, Yorkshire—An improved implement for raising or loosening turnips and other roots in the ground, and cutting off the tails thereof.

Recorded March 15.

582. Henry Bach, Sheffield—Improvements in sash-frames.
584. Robert M. Butt, Fairfield Works, Bow—Improvements in the manufacture of night lights.
585. Edward Hnmphrys, Deptford—Improvements in applying heat to steam-boilers.
586. François Loret-Vermeersch, Malines, Belgium—Invention for stopping trains on railroads.
587. William Monday, the younger, Kingston-upon-Hull—Improvements in preparing, mixing, and grinding the various kinds of plumbago, graphite, or blacklead, either together or separate, and with or without other materials, for polishing, lubricating, and for other purposes, and in otherwise preparing the same for sale.
588. George Grignon, 13 Sutherland-square, Walworth, Newington—Certain improvements in the means of launching or detaching boats from ships' sides or davits, and in the apparatus and tackle to be used for that purpose, that the operation may be speedy, spontaneous, and safe.
589. Henry Wickens, 4 Tokenhouse-yard, Bank—Improvements in the means of communicating signals in railway trains.

Recorded March 16.

590. Joseph Mitchell, Sheffield—Invention for supplying grease, tallow, or oil, either with or without the addition of blacklead, to locomotive engines, horizontal and beam engines, marine engines, and Nasmyth's patent steam hammer.
591. William Hill, Birmingham—Improvements in metallic pens and penholders, and in ornamenting metallic pens and penholders.
592. Mark Smith, Heywood, Lancashire—Improvements in looms for weaving.
593. John W. C. Wren, Tottenham-court-road—An improved construction of invalid bed.
594. Thomas Picton, Liverpool—Improved apparatus for erecting and supporting scaffoldings or stages, and which is also applicable as a fire-escape.
595. William Winstanley and Joseph Kelly, Liverpool—Improvements in the construction of force-pumps and their appurtenance.
596. Armand Manduit and Fréderic H. Ouin, Paris—An hydraulic machine.
597. Sir William Burnett and John W. D. Brown, Gosport—Improvements in constructing signal lanterns.

Recorded March 17.

598. Tony Petitjean and Louis Petre, 45 Upper John-street, Tottenham-court-road—Certain improvements in the manufacture of daguerreotype plates, and of electro-plated sheets of metal, part of which improvements may be applied to the production of polished surfaces on metallic articles.—(Communication.)
599. Eugène Breittmsyor, Paris—A new or improved mortising machine.
600. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the application of carbonic acid gas as a motive power.—(Communication from Joseph Ghilliano and Henri Cristin, Marseilles.)
601. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in steam-engines.—(Communication from Narcisse Duvoir, Liancourt, France.)
602. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in steam pressure and other indicators.—(Communication from François C. Breguet, Paris.)
603. Thomas G. Shaw, Old Broad-street—Improvements in apparatus to facilitate the tilting of casks, barrels, or other similar vessels of capacity.
604. Bsshley Britten, Anerley, Surrey—Improvements in projectiles.

Recorded March 19.

605. Benjamin Cook, Chester-street, Kennington—Improvements in machinery or apparatus for consuming smoke.
606. George Lowry, Manchester—Improvements in lubricators.
607. John Rimell, Covent-garden—Invention of a substitute for the turpentine ordinarily employed in mixing paints and colours.—(Communication.)
608. Edmund R. Fayerman, 79 Pall-mall—Improvements in portfolios for holding papers.
609. Richard Howson, Lancaster—Improved means of increasing the motive effect of screw propellers, and of diminishing resistance to motion in vessels propelled.
610. Vincent Scully and Bennett J. Heywood, Dublin—An improved mode of regulating the supply of gas to gas-burners.
611. James Taylor, Southwark—An improved means of consuming smoke in furnaces and fire-places.
612. Felix A. Chartraire, Paris, and 4 South-street, Finsbury—A new apparatus for fastening gloves, collars, shirts, and other similar articles.
613. Phillippe Roehrig, Paris, and 32 Essex-street, Strand—A new or improved alimentary substance.
614. Louis H. Crudner and Fréderic L. Koebrig, Tottenham-court-road—An improved apparatus for purposes of ventilation.
615. John Smalley, Bishopgate, Wigan—Improvements in railway carriage axles.
616. Richard E. Hodges, Southampton-row, and Charles Murray, Manor-place, Walworth—Improvements in door-springs.
617. Alexander R. Terry, 1 Adelphi-terrace, Adelphi—Improvements in apparatus for copying letters and other documents.
618. William Smith, Fenny Stratford, Bucks—Improvements in ploughing or trenching and subsoiling land.

Recorded March 20.

619. Archibald White, Great Missenden, Buckinghamshire—Invention for swinging beds, which will enable soldiers and others to sleep dry in tents or huts, and occasionally in the open air.
620. Jonathan Musgrave, Bolton-le-Moors, Lancashire—Improvements in steam engines.
621. William Taylor, Poolstock, Wigan, Lancashire—Improvements in the construction of pickers for power looms.
622. Thomas M. Fell, 74 King William-street, and Francis Squire, same place—Improvements in balance levers and apparatus for weighing, and modifications thereof, for the purpose of detecting base coin.
623. Thomas Stevenson, Little Bolton, Lancashire—Improvements in machinery or apparatus for gasing yarns.
624. Charles Marsden, Kingsland-road—An improvement in tent poles.
625. Benjamin O'Neale Stratford (Earl of Aldborough), Stratford Lodge, Wicklow—Improvements in aerial navigation, and in the application of the same to warlike purposes.
626. Edward T. Bellhouse, Eagle Foundry, Manchester, and David Longsdon, Grafton-street, Fitzroy-square—Improvements in the preparation or manufacture of materials for coverings for buildings and other purposes, such coverings being specially applicable to barracks and military storehouses.
628. Auguste E. L. Bellford, 32 Essex-street, Strand—A new and improved governor for engines and machinery.—(Communication.)
629. Isaac Rogers, North Haverstraw, New York—Improvements in the mode of treating iron ores.
630. Alfred V. Newton, 66 Chancery-lane—Improved machinery for forming moulds for casting.—(Communication.)

Recorded March 22.

631. William Miller, North Leith—An improved apparatus for the prevention of smoke and promoting ventilation.
632. John Morrison, Birmingham—An improvement or improvements in the manufacture of metallic pens.
633. Tell C. F. Lecour, Paris, and 4 South-street, Finsbury—Improvements in locomotion on canals and rivers.
634. James Biden, Gosport—Improvements in marine steam engines.
636. Matthew Semple, Plymouth—Improvements in railway breaks.
637. William Macnaught, Rochdale—Certain improvements in machinery or apparatus for spinning cotton and other fibrous substances.
638. Charles Carnell, Philadelphia, U.S.—Certain improvements in the manufacture of bricks.
639. John S. Russell, Millwall—Improvements in shipbuilding.

Recorded March 23.

640. George Whyatt, Openshaw, Lancashire—Certain improvements in machinery or apparatus for cutting piled goods or fabrics.
641. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery for combing wool and other fibrous materials.—(Communication from Francis J. Boussus, Fournes, France.)
642. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in hydraulic motive power engines.—(Communication from Narcisse Duvoir, Liancourt, France.)
643. Henry J. Morton, Leeds—Improvements in the construction of gas-holders or gasometers.
644. Charles F. Behn, Commercial Sale-rooms—Improvements in machinery for making moulds for casting metal.—(Communication.)
645. Frederick Ransome, Ipswich—An improvement in the manufacture of artificial stone.
646. William Young, Queen-street, Cheapside—Improvements in stoves or fire-places.

Recorded March 24.

647. James Willis, 75 Cheapside—Improvements in certain parts of the frames and furniture of umbrellas and parasols.

648. John L. Bachelard, 3 Charles-terrace, Asylum-road, Old Kent-road, and Henry Harvey, 73 Denbigh-street, Pimlico—Invention of making an animal manure for all agricultural, horticultural, and floricultural purposes, by reducing the flesh and bones of all or any of the animals of the earth and fishes of the sea to a pulp, powder, or jelly, with or without the aid of alkali.
649. Uriah Scott, Duke-street, Adelphi—Certain improvements in the construction of carriages, and of the various parts of the same.
650. Robert J. Jesty, Great Northern Railway, King's-cross—Improvements in apparatus for indicating between parts of a train of carriages on a railway.
651. David Elder, junior, Glasgow—Improvements in moulding or shaping metals.
652. James Niven, Keir, Perthshire—Improvements in the manufacture of paper, and in the production of textile materials.
653. T. F. E. Clewe, Paris—Invention of a new construction of locomotive engines, tenders, and railway carriages.
654. Griffith G. Lewes, C.B., Woolwich, and Joseph Gurney, St. James'-street—An improved construction of knapsack, convertible when required into a bed, a litter, or a tent.
655. William Brown, Gresham-street—An improved mode of preparing sewing silk for the market.
656. Lewis F. Edwards, New Bridge-street—An improvement in furnaces.—(Communication.)

Recorded March 26.

658. Robert S. North, Gorton, near Manchester—Improvements in the permanent way and sidings of railways.
660. John Gedge, 4 Wellington-street South, Strand—Improvements in machinery or apparatus for forming corners or curves.—(Communication.)
662. George A. Barrett, William Exall, and Charles J. Andrewes, all of Reading, Berkshire—Certain improvements in portable and fixed combined thrashing machines.
664. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for dressing flax, hemp, and other fibrous materials.—(Communication from Jean J. A. Lallier, Evreux, and François J. Vignaud, Paris.
666. Claude A. Busson, Paris—Improvements in feeding apparatuses applicable to machines for treating textile materials.
668. Francis Crossley, M.P., Halifax—Improvements in the manufacture of mosaic rugs.
670. Alexander W. Williamson, University College, Gower-street—Improvements in stoves or fire-places.

Recorded March 27.

674. John C. Bourne, Holmes-terrace, Kentish-town—Improvements in photographic apparatus.
676. William Yates, younger, Woburn-place, Russell-square—Improvements in the treatment of grain from which beer or spirit has been made.
678. John Getty, Liverpool—An improvement in the construction of steam and other vessels.

Recorded March 28.

680. George L. Turney, Wood-street, Cheapside—An improved mode of arranging or packing pins and needles for sale.
682. John S. Perring, Radcliffe, Lancashire—Improvements in the permanent way of railways.
684. François E. Hudde and Jean B. E. Fouquet, Paris, and 4 South-street, Finsbury—Certain improvements in the construction of pyrometers.
686. William Dray, Swan-lane—An improved gear for communicating power from horses or cattle for the purpose of driving machinery.—(Communication.)
688. Ernest H. Becker, Altham, Lancashire—A new or improved projectile.
690. Thomas M'Low, Middle-row, Holborn—Improvements in screw-propellers.
692. Joseph Peabody, Old Broad-street—Improved machinery for obtaining motive power by the action of the wind.—(Communication.)

Recorded March 29.

694. John Gedge, 4 Wellington-street South, Strand—Improvements in the means of stopping or retarding railway trains.—(Communication from Franz S. H. Schirges and Carl Fuchs, Munich.)
696. Marie J. T. Gillot and Cécile C. Beauvais, 30 Upper Charlotte-street, Fitzroy square—Improvements in purifying grain, vegetable or botanical matter, and cochineal.
698. James Porritt, Stubbins Vale Mills, near Ramsbottom, Lancashire—Certain improvements in steam-engines.
700. John Blair, Glasgow—Improvements in hats and other coverings for the head.
702. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in anchors.—(Communication from Louis F. F. David, Havre.)
704. William James, Crosby Hall Chambers—Improvements in the manufacture of screw bolts.

Recorded March 30.

706. Henry W. Parnell, 13 Bryanstone-square—Improvement in the construction of ships and boats, so as to increase their buoyancy, and diminish their rolling motion.
708. William Swain, Birmingham—Certain improvements in furnaces for japanners' stoves, ovens, boilers, and kilns, and which improvements are also applicable to other fire-places, by which combustion is rendered more complete, and the fuel thereby greatly economised.
710. George H. Babcock and Asher M. Babcock, Westerly, Rhode Island, U.S.—Improvements in presses for printing in colours, called polychromatic printing presses.
712. Joseph Morgan, Manchester—An improvement in the manufacture of candles in which tallow is used.
714. Edward V. Neale, Russell-place, and Thomas Dawson, King's Arms-yard—Improvements in handles and parts of handles for umbrellas, walking sticks, knives, and for other like articles, and for articles of furniture in stoppers, finger plates, medallions, jewellery, furniture, and other decorative articles.
716. Theophilus W. Bunning, Newcastle-upon-Tyne—Improvements in steam-engines.

Recorded March 31.

718. Charles Whitley, Manchester—Improvements in machinery or apparatus for drilling.
720. William Corbitt, Elm Tree-bank, Rotherham, Yorkshire—Improvements in warming and ventilating apartments, parts of which improvements are applicable to the prevention of smoky chimneys.
722. William E. Newton, 66 Chancery-lane—An improved mode of constructing centre-bits.—(Communication.)
724. George F. Wilson and George Payne, both of Belmont, Vauxhall—An improvement in treating oils to obtain an elastic product.
726. Elizabeth Abbott and Matilda Abbott, both of Horningsea, Cambridgeshire—Improvements in stays.

Recorded April 2.

728. Adolphe E. L. C. Finimerhans, Liege, Belgium—Invention of forcing projectiles applicable to artillery as well as to portable fire-arms.
730. James Shand, 245 Blackfriars-road—Improvements in fire-engines.
732. Charles Crews, 8 Montague-terrace, Bow-road, and Henry G. Gray, St. James'-street—Improvements in preparing and using deodorizing or disinfecting compounds.
734. Richard Peyton, Bordesley Works, Birmingham—Improvements in the manufacture of iron gates and fences.
736. William Lund and William E. Hipkins, Fleet-street—Improvements in the manufacture of cork-screws.

Recorded April 3.

738. Robert C. Witty, 9 Torriano-avenue, Camden-road Villas—An improved method of reflecting and diffusing solar light.
740. Thomas Prideaux, Birmingham—A new or improved plough for draining and other similar purposes.
742. Hiram Powers, Florence, Tuscany—Invention of forming perforations or throats to the cutting edges of files or rasps, for allowing the particles cut away to pass through, and to prevent the instrument from clogging or choking.
744. William E. Gill, Totnes, Devonshire, and Henry B. Sheridan, Parsons-green, Middlesex—Invention of treating fish for oil, and utilizing the products of such process.
746. Jacob Maas and James Adams, both of White Hart-yard, Southwark—Improvements in mills for splitting or grinding beans, pease, corn, and all kinds of grain.
748. Henry R. Fanshawe and John A. Fanshawe, North Woolwich, Essex—Certain improvements in the manufacture of waterproof fabrics of the vulcanised, sulphurised, or cured class.
750. Maximilien Evrard, St. Etienne, France—An improved continuous drawing compresser for moulding or bruising several substances or mixtures.
752. Christopher Nickels, Albany-road, Surrey, and James Hobson, Leicester—Improvements in weaving pile fabrics when wires are used.

Recorded April 4.

754. Robert Hills, Caroline-place, City-road, Thomas Miles, Queen-street, Finsbury, and Henry Monument, Caroline-place, City-road—Improvements in bottles, jars, and other similar vessels, to facilitate the corking or stopping of them.

Recorded April 5.

756. Thomas Squire, Latchford, Chester—Improvements in removing hairs from hides and skins.—(Communication.)
758. Isidore Carlhian, 26 Rue du Sentier, Paris, and François I. Corbière, 27 Castle-street, Holborn—Improvements in apparatus for making soda water and other aerated liquids—(Communication.)
760. Joseph Brazier, Wolverhampton—An improvement or improvements in revolving or repeating fire-arms.
762. Denny Lane, Sundays Well, Cork—Improvements in obtaining power by water.
764. Abram Longbottom, Soho Foundry, Meadow-lane, Leeds—Improvements in preparing sand and materials to be used when casting.—(Communication.)
766. Peter Arrive, 7 Spencer-street, Darnley-road, Gravesend—Improvements in safety valves of steam boilers.

Recorded April 7.

768. Robert W. Waithman, Bentham House, Yorkshire—Improvements in machinery or apparatus for the manufacture of lint or similar substances.
770. Alexander Rollason, Birmingham—Certain improvements in photography.
772. Richard Stones, Kingston-upon-Hull—Improvements in taps or cocks for drawing off fluids.
774. Joseph Aresti, Greek-street, Soho-square—Invention of a method for obtaining improved effects upon drawings washed or painted on stone.
776. David G. Jones, M.D., 14 Harrington-square, Hampstead-road—A new or improved farinaceous food.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

DESIGNS FOR ARTICLES OF UTILITY.

Registered from March 2 to March 24.

March 2d,	3690	J. Rhodes, Nottingham,—"Radiating gas-stove."
3d,	3691	W. P. Helby, Portsea,—"Stays and corsets."
7th,	3692	J. Elce and J. Bond, Manchester,—"Temple-holder.
"	3693	S. Mordan, City-road,—"Pencil-leads protector."
8th,	3694	J. Brookes, Huddersfield,—"Silk-preserver."
19th,	3695	J. Deacon, Clerkenwell,—"Beer-engine."
20th,	3696	Harely and Jolly, Westbourne-grove,—"Letter-damper."
"	3697	W. Standing, Rochdale,—"Mule-spring."
"	3698	J. B. Harman, Bucklersbury,—"Oil-burner."
23d,	3699	Wheatman and Smith, Sheffield,—"Mill-saw tiller."
24th,	3700	Price's Candle Company, Vauxhall,—"Hospital stove."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered.

March 1st,	642	A. Jones & Co., Dublin,—"Folding-top table."
2d,	643	R. Frost, Oxford-street,—"Barrel tilt."
5th,	644	Butterworth & Co., Southwark,—"Shoe fastener."
14th,	645	A. H. Jones, St. Luke's,—"Pocket detector."
17th,	646	W. Bradshaw, Dublin,—"Camp bedstead."
22d,	647	W. P. Astley, Falcon-square,—"Brace."
24th,	648	G. W. Willis and W. Gosling, Hampstead-road,—"Cooking lamp."

TO READERS AND CORRESPONDENTS.

Wolverton.—We cannot recommend *best* works. He will learn more from studying the details given in the *Practical Mechanic's Journal,* than from any set work on the subjects he mentions, however inviting they may appear.

W. B. (Boston.)—We shall be glad to have the particulars at his convenience.

W. S. (Alvechurch.)—We shall give his notes next month.

C. J. B. (Woolwich.)—The favour will at least be mutual, so that we cannot accede to his proposal.

Plate 171.

WIND

G.A.COX.

Fig. 1.

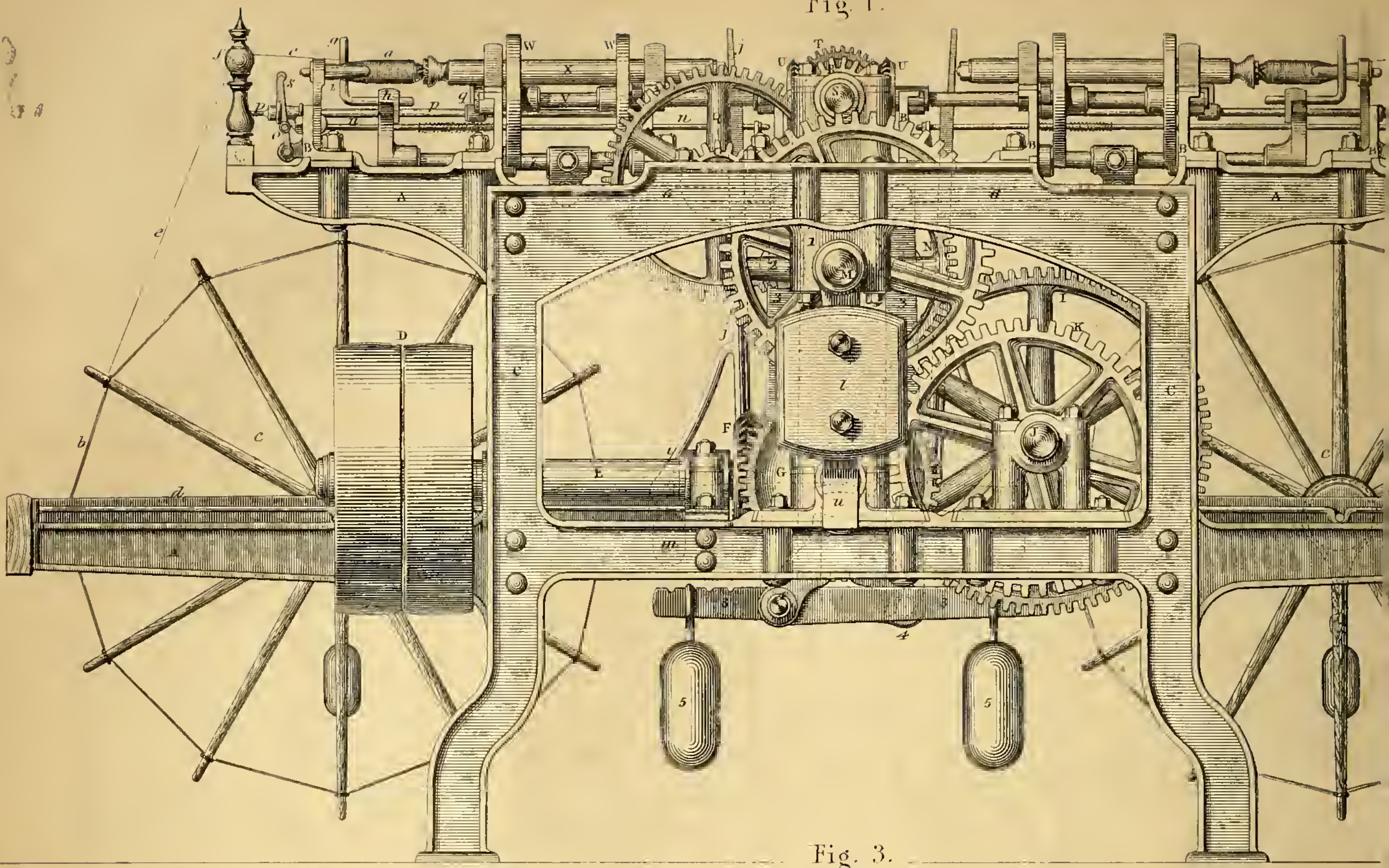
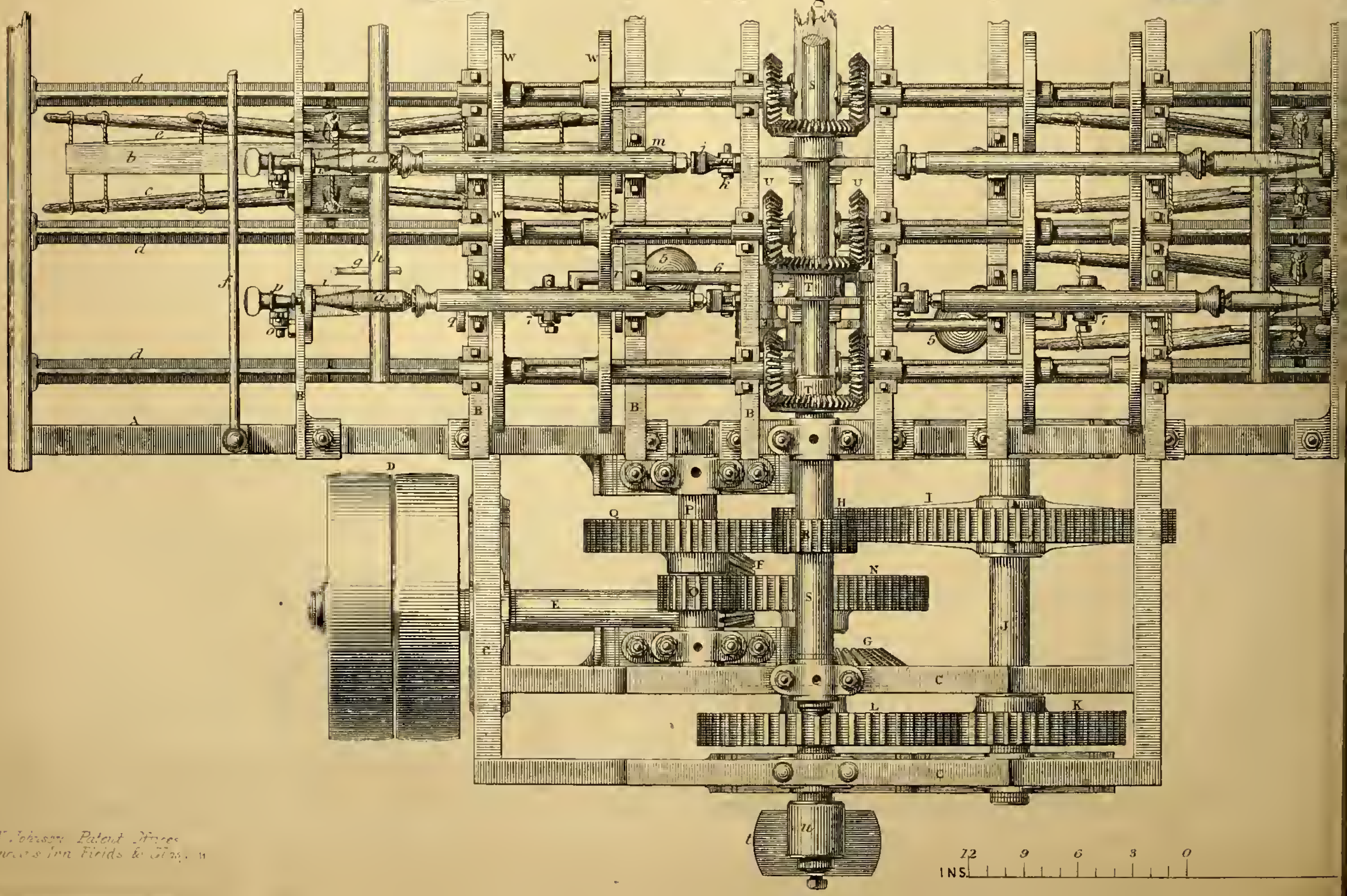


Fig. 3.



W. Johnson Patent Offices
47 Lincoln's Inn Fields & Glasgow

NG MACHINE,

OCHEE WORKS, DUNDEE.

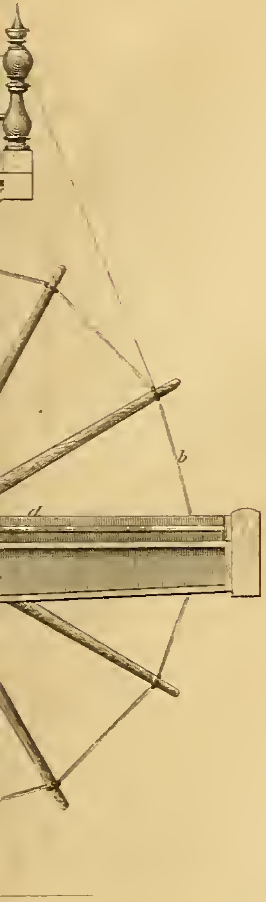
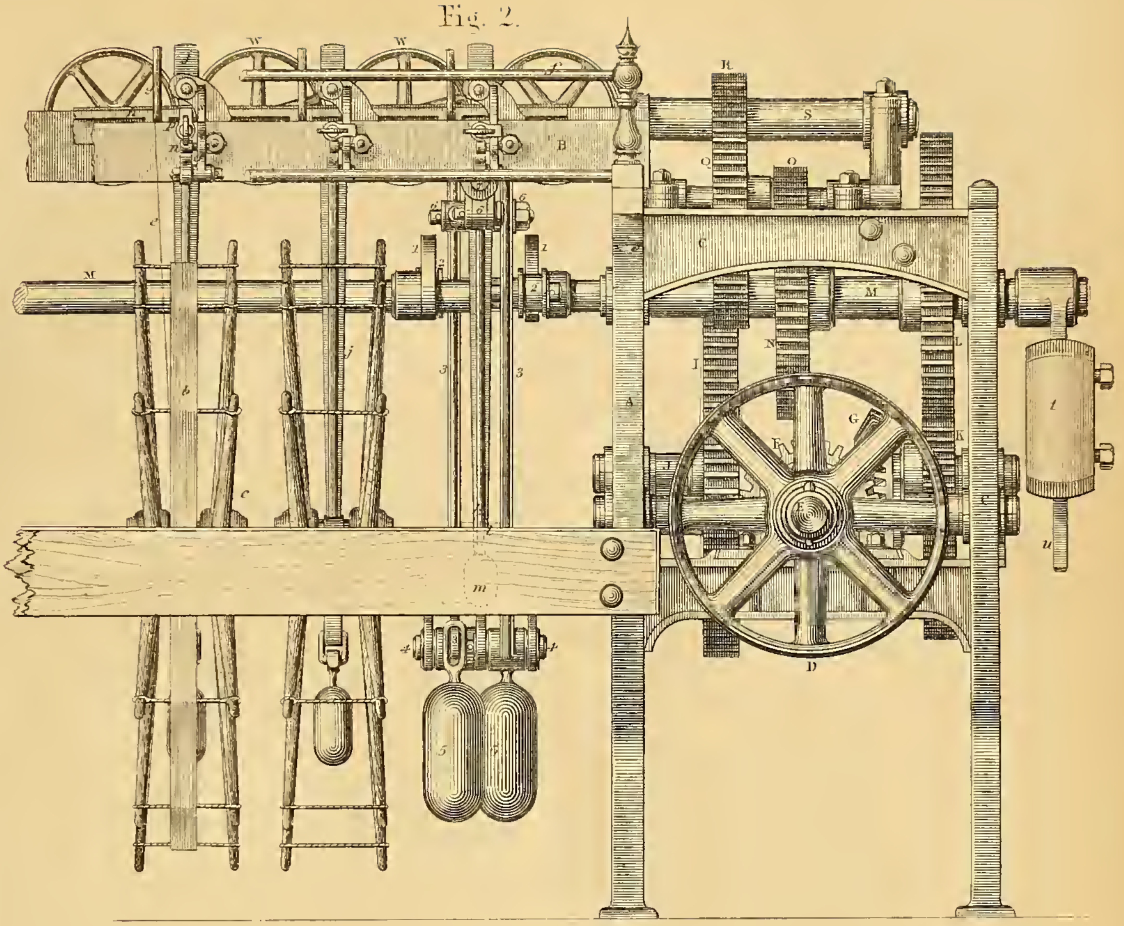


Fig. 2.



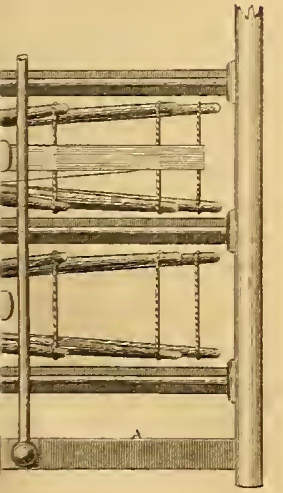


Fig. 4.

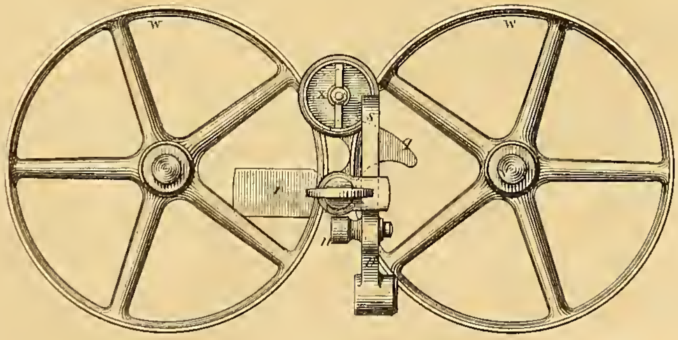
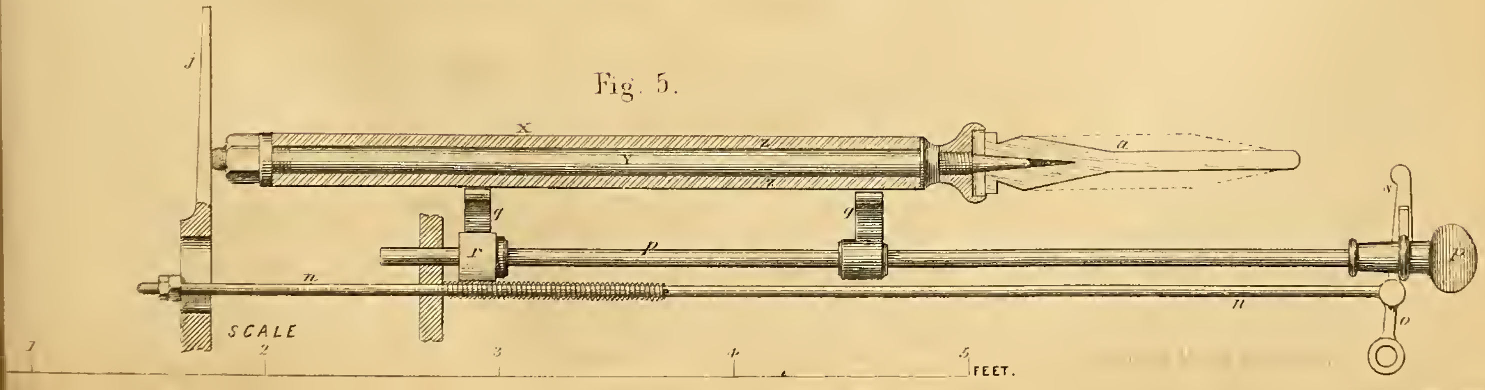


Fig. 5.



WINDING MACHINE,

G.A. COX, LOCHEE WORKS, DUNDEE.

Fig. 1.

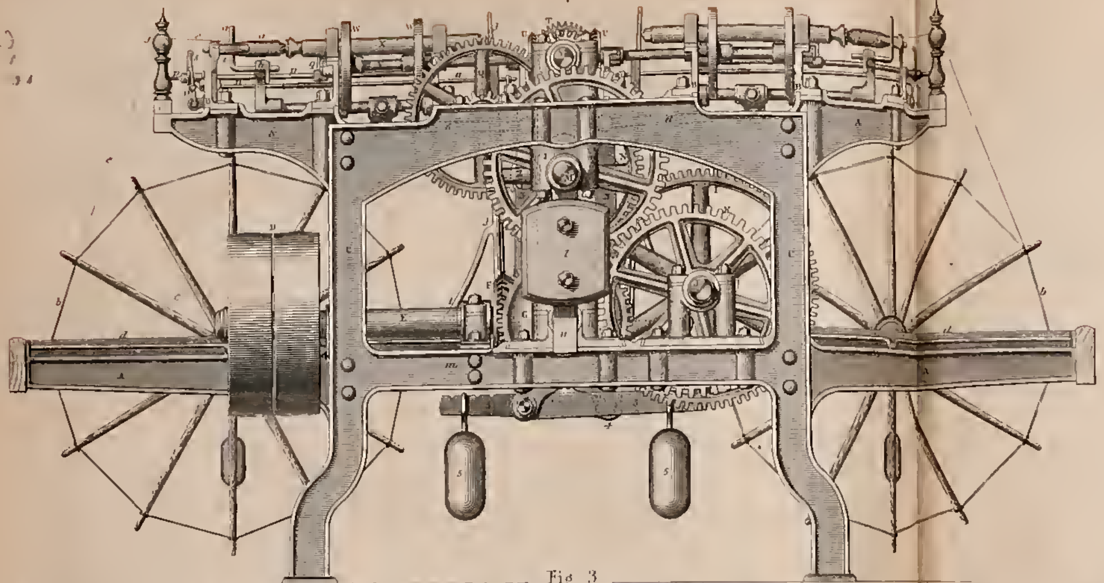


Fig. 2.

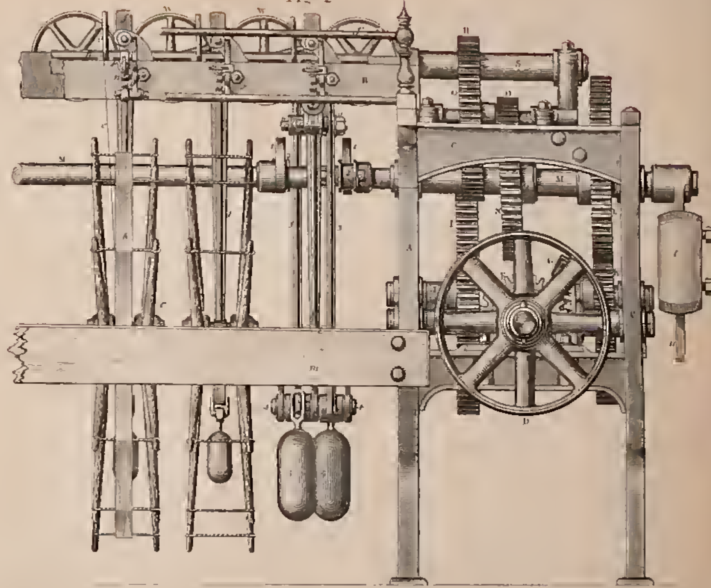


Fig. 3.

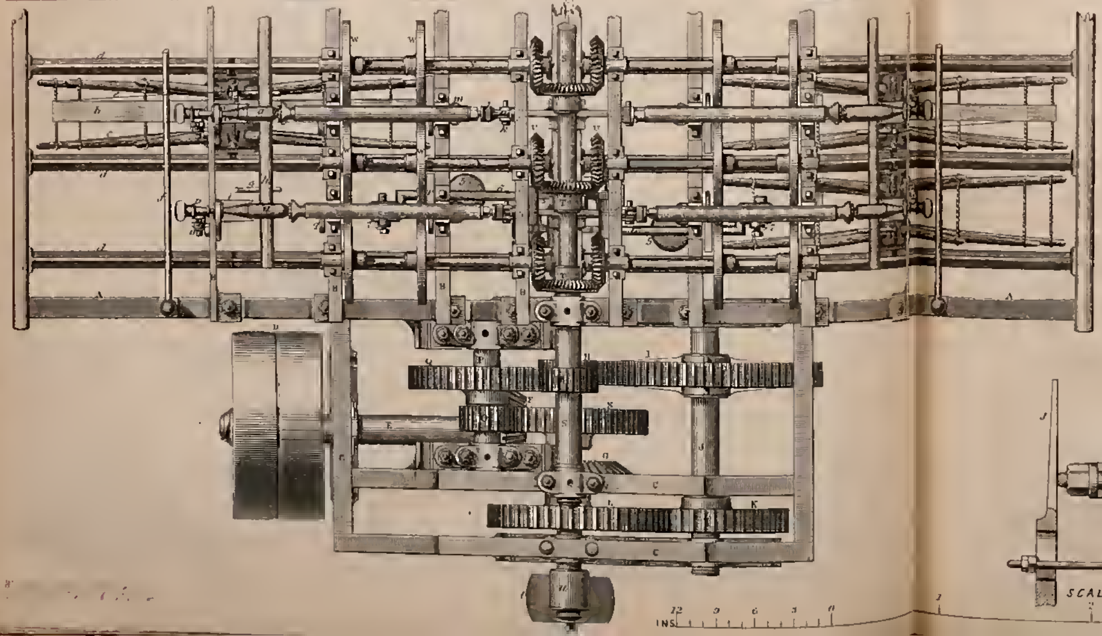


Fig. 4.

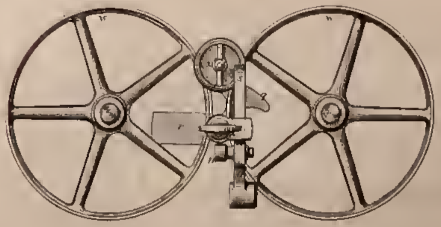
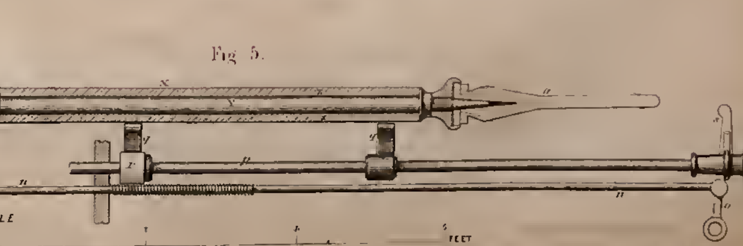
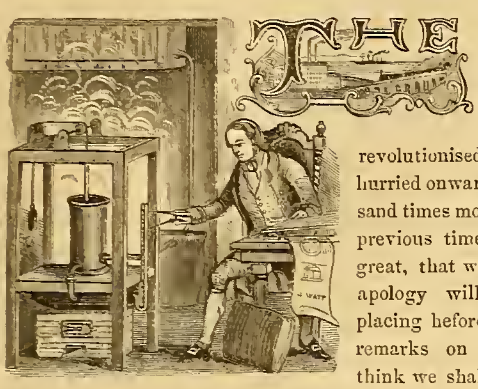


Fig. 5.



NOTES ON THE EARLY HISTORY OF THE STEAM-ENGINE.



THE interest which attends the history of that wonderful invention, by which the world is being revolutionised, and civilization hurried onwards, at a pace a thousand times more rapid than at any previous time, is necessarily so great, that we cannot think any apology will be required for placing before our readers a few remarks on the subject. We think we shall be able to show, that there is little ground for throwing back, as some have attempted to do, the invention of the steam-engine, or even of the germ of the machine, to a remote period; and that, though claims have been put forward by several modern nations in behalf of countrymen living more than two hundred years ago, the invention of a real steam-engine must be referred to an epoch quite modern.

The honour of having invented the first machine, the moving power of which was steam, has been usually ascribed to Hero, of Alexandria (100 B. C.), whose little treatise on Pneumatics contains a description of various kinds of apparatus, intended to illustrate some curious effects of air and water. The subjects treated of are taken without attention to order or scientific connection, nor is there any statement of theory or explanatory comment. We do not believe, that if Hero were to come to life at the present day, he would dream of claiming what others have claimed for him; and we may be sure that he would be no little astonished to see the wonderful machines which had their origin, according to some persons' notions, in his little toys. Let us see how he has himself described the apparatus in question. First, there was a vessel containing water, and having no opening, except through a narrow tube, in which a ball was placed; and the water being heated, its steam drove out the ball. If we have the germ of any modern invention here, it must be the steam cannon, hardly of a steam-engine; for the apparatus does not approach so near our machine as a common kettle, furnished with its lid, and such a vessel was doubtless of much greater antiquity than Hero.

Looking farther into his book, we find him describing several pieces of mechanism for sounding the pipe of an automaton, for making a wooden dragon hiss, and turning round miniature men, all by means of air compressed or expanded by the action of heat. But these cannot be deemed worthy of consideration with reference to the origin of the steam-engine, and we proceed to the description of the apparatus, in which some have thought they saw the prototype of the greatest machine of modern times. His object, in this instance, was to make a small sphere turn upon its axis by means of a heated vessel; and this he effected by placing over the vessel (which, of course, contained water, and which was covered by a lid) a hollow sphere, with two little tubes, inflected in opposite directions, connecting its interior with the external air. A tube passed out of the vessel, and was loosely fitted into the sphere, which was kept in its place by another piece of metal, fixed to the opposite side of the vessel, and fitting, pivot-like, into a hollow on the face of the sphere, over against the point where the tube from the vessel entered it. Heat being applied to the vessel, steam was generated, and passed up the tube into the sphere, and thence escaping into the air, through the two inflected tubes, turned the sphere round. Arago, amongst others, sees in this toy the first recorded instance of the employment of steam as a motive power; but as the kettle has been in use, we may conjecture, for ages previously, and men had often seen its lid dancing, and steam escaping, the merit of the invention of the steam-engine will hardly be taken away from the moderns by this childish apparatus. At that time, it must be observed, the existence of steam was unknown. It was thought that heat changed water into atmospheric air, an error entertained long after the time of Hero; and we find, in another part of the treatise, a description of an apparatus in all respects resembling the above, except in the substitution of a current of heated air for the current of steam.

The Byzantine historian, Agathias, relates a story, which has been sometimes transferred to the pages of those who have undertaken to trace the early source of the steam-engine. The story is to this effect:—Zeno and Anthemius were two gentlemen living at Byzantium, who had once been friends, but, living in too close proximity, they became bitter enemies. Zeno one day gave an entertainment to a party of his friends in a room placed immediately above another which was occupied by Anthemius. The latter, hearing beforehand of the intended feast, had prepared cauldrons, filled with water, under which he placed fires; and at the height of the entertainment he directed the steam, through pipes, upon the ceiling, in such a way that it shook the room where the party sat, and spread such an alarm through it, that host and guests rushed into the street, believing that an earthquake had taken place. This story might serve to fill a page in an ancient jest-book, but it can hardly be taken for severe fact, nor does it throw much light upon the infancy of the steam-engine.

All the industry of the learned has not succeeded in finding the slightest hint which can be made to bear upon this subject, until, in 1562, a certain Mathesius, a schoolmaster in a small Bohemian town, published a volume of addresses to the miners of the neighbourhood, in which there is a passage that has been thought to speak of the possibility of constructing an apparatus similar to our steam-engine. Addressing the miners, Mathesius says—"Celebrate in your hymns the excellent man who brings the ore to the surface by help of the wind, and water by means of fire; that by using the water, the wind, and fire, as well as good machines, the water below and the ore may be raised from great depths, whilst the expense is less." We ourselves are unable to find in this passage any allusion to steam machinery, being strongly impressed with the belief, that Mathesius referred merely to apparatus set in motion by wind or heated air.

It has been stated, that in some work published at Leipsic, in 1597, there is a description of an Æolipyle, which it was said could be adapted to the turning of a spit. An æolipyle was an old and well-known philosophical toy, formed of a hollow ball of metal, with a hole, into which a tube could be fixed. The ball was filled with water, and steam was generated, which rushed through the tube. If the account in the book we speak of was at all accurate, we have here some approach to the application of steam as a motive power. Still we have not yet arrived at the steam-engine.

About the beginning of the seventeenth century, a gentleman of rank in France, named David Rivault, who was one of Louis the Thirteenth's preceptors, made certain experiments, which showed clearly the enormous power which lay dormant in water, until called into activity by heat. A thick bomb, containing water, burst into pieces when placed over a fire. An æolipyle was shattered, when the hole by which the steam escaped was closed. These experiments preceded those of the Marquis of Worcester, with a cannon filled with water, of which he closed the mouth and touch-hole.

It was only a little before this time that Science had begun to emancipate herself from the thraldom of the Schoolmen, and to push her inquiries through the vast field of nature, on paths which neither Aristotle nor his followers had pointed out. During the dark ages, a few scattered lights had indeed appeared, but persecution or death awaited such men as Roger Bacon, Giordano, Bruno, and Cardan, for venturing into roads unauthorised by the Stagyrite, and forbidden by the church. But in the course of time society shook off its fetters; and when it had gained liberty of conscience by Luther's assistance, there were not wanting men to work out its scientific regeneration. Three, in particular, appeared on the scene about the same time, and founded in different nations, and after different fashions, the grand philosophy, which has never ceased growing in vastness and utility to this day. This great mental revolution was mainly the result of the uncombined efforts of Bacon, Descartes, and Galileo. The old prison-house fell, never to rise again; and upon its ruins arose a new edifice, to which thousands rushed to listen to their precepts, and profit by their example. The period of this arduous work was comparatively short. It may be said to commence with the first labours of Galileo, at the close of the sixteenth century, and to end about fifty years afterwards, with the death of that philosopher. The new system was then inaugurated, and science, having discovered at last the true direction of its progress, set forward on a march which nothing can now interrupt. Its object was not effected without a severe struggle, for the powers arrayed against it were gigantic and unscrupulous. From some of its contests it came not out victor, for the regenerators of philosophy had not only to conquer others, but themselves. They were entangled with ancient errors, which, in some cases, were too much even for them. Metaphysical subtleties darkened the battle-ground, and in mixing together religious notions and scientific questions, it is no wonder that they were frequently puzzled and discomfited. When we find the philosophers of that day reasoning upon the *plenum* and the *vacuum*, distinguishing between the essential and the accidental properties of bodies, discoursing on the *siccum* and the *humidum*, dissertating on the number and the properties of the elements, and seeking for the essential causes of phenomena, can we be surprised at failures and mistakes? Still were their hypotheses without end as to the nature of fire, and the combination of the elements. Still was nature endowed with feelings and affections. In short, the vain subtlety of scholastic theories still abounded. Not only were the methods of that day abortive, but the objects were often puerile or absurd. When we see men laboriously trying to account for the sounds of Memnon's statue, the mysterious performance of Pope Sylvester's organ, or the flight of Archytas's dove, who can forbear smiling, with some degree of contempt, at efforts wasted on such objects? Volumes were written to expound theories of the destruction of the golden calf, and men of fine intellect gravely gave us their ideas as to the number of angels that could find a resting-place on the point of a needle without jostling!

About the middle of this misty period, there flourished in France an obscure architect and engineer, named Solomon de Caus, for whom the French claim the honour of having invented the machine which, in our time, plays such an important part in the world of mechanics. De Caus published a book in 1615, with this title, "The Causes of Moving Forces, with divers useful and amusing Machines." Singularly enough, this book was published by an English bookseller at Frankfort, the explanation of which may be found in the facts, that the author had resided for some time in England in the service of the Royal family, and that he was then living at Heidelberg, as architect and landscape gardener to the Elector Palatine, who had married a daughter of our James I. In these capacities he added to the Elector's splendid castle, and laid out his gardens. In the book referred to, De Caus enumerates several methods of raising water above its level; but the passage on which much stress has been laid is to this effect:—"The third method of raising water is by means of fire, and this may be applied to several machines. For example, let there be a stout ball of copper, having a tube at one side, through which water can be poured, whilst another tube enters the ball at the top and passes down almost to the bottom. Now, if the ball, filled with water, the side pipe being securely closed, be placed over fire, the water it contains will be driven out through the tube at the top." Arago's remark on this passage is, that this machine is a true steam-engine, capable of being turned to account as a pump. But it may be replied, that it will only do this as regards the water contained in the ball, and when that is expelled, more must be introduced in the same way as before. Doubtless, by a further contrivance—namely, by conducting the side tube into a reservoir of water, a fresh supply would be forced into the ball as the first disappeared through the other tube. But De Caus says nothing of this; on the contrary, he tells us to close the side pipe of his ball securely. The fact appears to be, that he had no intention of describing a machine, but only of giving his readers an illustration of his meaning when he spoke of elevating water by means of heat. The thing remained altogether incomplete as a machine, and was probably looked upon by the describer, who was not even the inventor, as much more curious than useful. In point of fact, the principle was well known previously to ingenious persons, and as a proof of this assertion, we may refer to Porta's work on Pneumatics, published at Naples in 1601, in which may be found described a means of ascertaining "the number of parts of air into which one part of water could be converted by heat." It was at that time supposed that heat converted water into atmospheric air, and Porta made use of the pressure exerted by steam upon the surface of water contained in a small reservoir. But long before Porta's time, it was known that water could be raised—that is, forced—out of its place by steam pressure. Hero's work, of which we have already spoken, refers to more than twenty kinds of apparatus founded on the same principle. We cannot, then, allow of the claim which has been put forward by the French in favour of their countryman as the inventor of the steam engine. The supposed inventor goes into no detail, describes none of the applications of the apparatus, but passes on to other matters, satisfied with having shown us how water could be made to leap out of a copper ball. If we inquire for the effect that an invention deemed capable of being applied to industrial operations had upon his contemporaries, we shall find that it passed unnoticed. The only writer who has mentioned De Caus is a German named Schott, who published a book on hydraulics in 1657. Not a single author of his own age speaks of him, not even his own father, who, some years after the publication of Solomon De Caus's book, wrote a treatise upon various methods of raising water.

Other passages in De Caus's book have been cited by those who set him up as the discoverer of the principle of the steam-engine. In one place he tells his readers, that if a ball of copper filled with water, and made perfectly tight, is placed upon a hot fire, the compression, as he chooses to say, will be so great that the ball will burst into pieces with a loud noise. The violence, says he, will be very great when the water exhales into air by the action of heat. But what does this prove beyond the fact, that he was acquainted with an old experiment? His explanation of the phenomenon was, that the air produced from water by heat acted upon the water in the closed vessel, and by its pressure rent it in pieces. The fact that the vapour of water exerted a certain amount of force had been known for ages before De Caus's time. It was not the knowledge of that fact that was wanting to the creation of the steam-engine, but the application of it to a useful purpose. In another passage, the author shows he was aware of the hourly phenomenon of water being driven into the air in the shape of vapour, and coming back in the shape of drops of water. It will not be inferred from this, that he held any correct theory on the subject of vaporization. In his day, this subject was involved in mystery, for every one imagined that water, made to disappear by heat, was converted into atmospheric air.

This is all that can be adduced in favour of De Caus, and we think that, when the matter is looked at by unprejudiced persons, they will find nothing whatever to justify his claim to the rank of a great but neglected discoverer.

The next person brought forward to tell us about the steam-engine in its infancy, is a certain Giovanni Branca, an Italian architect, who published a book at Rome in 1629, containing a list of the principal machines known at that time. One of the machines he describes is an æolipyle thus made: the upper part of a hollow metal statue is placed on the fire, and water is introduced within it by means of an orifice closed by a screw; a tube placed in its mouth served to conduct the water as it was ejected against the shafts of a horizontal wheel, which, by means of a toothed wheel, set two stampers in motion, and thereby substances could be reduced to powder. There is, however, no analogy between such an apparatus and our steam-engine; for the principle of the latter resides in the use made of the elastic force of steam inside a closed vessel, whilst the æolipyle, described by Branca, acts by the direct impulsion of a current of steam directed upon a wheel. A current of air issuing from the nozzle of a pair of bellows would have had an exactly similar effect. It seems to have been an apparatus like this of Branca's which Bishop Wilkins alludes to in his *Mathematical Magick* (1648). Æolipyles, says the Bishop, may be employed in several ways, sometimes by way of amusement, and sometimes usefully to act on the sails of a wheel placed in the corner of a chimney, and connected with a spit.

Although the apparatus mentioned by Father Kircher, in his *Magnes, sive de Magnetica Arte*, published at Rome in 1641, has never been spoken of as an embryo steam-engine, we shall refer to it as an instance of the way in which experiments were made with hot water in various directions, and as an instance of the erroneous views that were entertained of the nature of steam. The apparatus consisted of a metal vessel, having water in the lower part; a tube inserted in the top was conducted into an upper vessel, also holding water. Now, says Kircher, if you place the lower vessel upon the fire, after having filled it with water, the *air* in it, being compressed by rarefaction, and only finding vent by the tube, will rush violently through it, and try to escape into the upper vessel, but meeting with water there, causes great agitation in it, and finally drives a stream high into the air. We of this day know that the cause of this *jet d'eau* was the pressure of the steam generated in the lower vessel; but Kircher imagined it was owing to the action of air expanded by heat. As long as fundamental errors touching the nature of steam prevailed, it was impossible that any genuine steam-engine could be constructed.

The order of time now makes us acquainted with the Marquis of Worcester, who in England is universally believed to be the real inventor of the steam-engine. The Marquis published a book in 1655, entitled, "A Century of Inventions," and it is by virtue of an enigmatical passage in this book that he has gained the honour of being deemed the originator of our grand servant of all-work. Let us turn to the book and see what can be made of the passage in question. The invention by which the Marquis has won so much celebrity is numbered 68, and it is described in these words:—"An admirable and most forcible way to drive up water by fire; not by drawing or sucking it upwards, for that must be, as the philosopher calleth it, *intra sphæram activitatis*, which is but at such a distance. But this way hath no bounder, if the vessel be strong enough; for I have taken a piece of whole cannon, whereof the end was burst, and filled it three-quarters full of water, stopping and screwing up the broken end, as also the touch-hole; and making a constant fire under it, within twenty-four hours it burst, and made a great crack; so that having a way to make my vessels so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water run like a constant fountain stream forty feet high; one vessel of water, rarefied by fire, driveth up forty of cold water; and a man that tends the work is but to turn two cocks, the one vessel of water being consumed, another begins to force and refill with cold water, and so successively; the fire being tended and kept constant, which the self-same person may likewise abundantly perform in the interim between the necessity of turning the said cocks."

Our first remark upon the passage will be this, that if any of our readers is able to make sense of it, and resolve the riddle, we shall feel very much obliged to him if he will enlighten us. After reading it over attentively several times, it seems to us utterly unintelligible; and we are quite sure, that if the Marquis had not described the invention more clearly in the specification of any patent he might have taken out for his invention, he would have stood a poor chance in a court of justice. We defy any engineer or mechanic, however skilful he may be, to construct a steam-engine from that description. Our second remark will be in the shape of a question. How came it that no one ever turned this "admirable and forcible way" of driving up water to any useful purpose? Why was it not laid hold of immediately, and made to do good service to the age in which the inventor lived? Whatever answer may be given to these questions, the fact is certain, that the invention is only heard of in the pages of the Marquis's book, that it met, like his other inventions, with a cold reception from his contemporaries, and that it was rejected by all the scientific and practical men of the age. We can only draw one conclusion—that the invention was either a dream or a toy. There have been many such, both before and since the Marquis's day, and they have always met with the same fate. We did not require a nobleman to tell us that a cannon filled with water will burst, if a sufficient degree of heat is applied to it. That fact was previously well known to all the world. The Marquis subsequently published another work, setting forth the extraordinary utility of his *admirable* invention; but he does not add a single word of explanation as to the construction of the apparatus. Looking at the Marquis's private character, and at the wild and chimerical projects which his first book contains, we shall take the liberty of doubting whether this grand invention was anything but a useless piece of rodomontade. Walpole has sketched his character in a few lines, and we are told that he was making promises of two hundred thousand crowns, two thousand stand of arms, eight hundred barrels of gunpowder, and thirty or forty vessels, fully equipped, at a time when he had not a shilling in his purse, nor even possessed powder enough for a single shot.

Denis Papin was the next person who busied himself with the application of fire to water; but his experiments terminated in little of practical importance, as we have already shown in our sketch of his life. That sketch renders it unnecessary that we should, in this place, relate the story of his attempts and his failures.

We then come to Savery, who was, beyond all doubt, a real inventor; and whatever hints he may have received from those who had gone before him, to him is due the honour of having constructed a machine that would work under the impulsion of steam. Savery's patent was dated in 1628.

SELF-ACTING YARN WINDING MACHINE.

By G. A. Cox, Esq., *Lochee Works, Dundee.*

(*Illustrated by Plate* 171.)

The important improvements recently added to the yarn winding machine, by Mr. G. A. Cox, of Dundee, very materially affect the performance of that valuable machine. The general details of Mr. Cox's modifications apply to winding machinery of various kinds, as employed in the different operations of the manufacturer of textile goods. For our present illustration, however, of its merits, we shall take the machine as fitted for taking the place of the ordinary hank winding machine for producing cops or pirns from hanks.

In this machine, the pirn spindles are of iron or steel, covered with leather, gutta percha, or some such elastic material as will answer the frictional requirements of this system of driving. Each spindle is disposed horizontally, and so that its external covering is in frictional contact with surface wheels beneath; the latter being carried upon horizontal spindles set at right angles with the main centre shaft, from which the surface wheels are driven, and parallel with the spindles themselves. When the cop or pirn has been filled with yarn by the winding action, it stops automatically, and without any extraneous attention. This movement is produced by the pressure of the spindle end against a lever or spanner, which disengages a duly-arranged catch, and permits a pair of eccentrics or cams, situated beneath the spindle, to disengage the frictional surfaces, bringing the spindle clear of its driving discs or wheels. Should a thread break during the winding action, or should it be necessary to stop any spindle for any other reason, a small thumb handle, projecting from the catch or stop, gives the attendant the necessary means of providing such stoppage. This thumb handle requires but a very slight pressure to throw it off, and thus permit the eccentrics to lift the spindle clear off the driving discs or wheels. The same lever or spanner which bears upon the spindle end, serves to afford power by means of a weight or spring, for effecting the hard or soft winding-on of the yarn upon the pirn. An eccentric motion is also fitted up in connection with the driving gear of the machine, for the purpose of increasing the velocity of the spindle, when the yarn is winding on the small part of the pirn, thus imparting a uniform speed to the take-off of the yarn from the reels or holders. This same eccentric motion gives a variable motion to the guides for laying the yarn on the pirns. There is also a weight attached to the eccentric motion shaft, for balancing the power required for driving the machine.

Fig. 1 on our Plate is an end elevation of the machine, as looking on the end at which the driving details are placed; fig. 2 is a side elevation; and fig. 3 is a plan corresponding to fig. 1. Figs. 4 and 5 are enlarged views of the spindle details; the former representing the spindle in end view, as resting between its driving pulleys, and the latter showing the spindle in longitudinal section, and in connection with the details of the stopping movement. The framing of the machine is made up of the transverse or end standards, A, of cast-iron, and the several longitudinal cast-iron bars, B, in which are the bearings for the various spindle drivers and other details. The driving details are carried in a separate framing, C, bolted up against one end of the main frame. They consist of a pair of driving pulleys, D, carried upon a short transverse shaft, E, revolving in bearings in the framing, C. On the shaft, E, is keyed a bevil wheel, F, in gear with a bevil wheel, O, fast upon a short longitudinally-disposed shaft, the inner end of which has fast upon it a pinion, H, in gear with a spur wheel, I, fast on a parallel shaft, J, carried in bearings towards one side of the frame, C. On this shaft, J, is keyed an eccentric spur wheel, K, arranged to gear with a corresponding eccentric spur wheel, L, upon a parallel shaft, M, carried in bearings in the frame, C. It is by means of these eccentric wheels, K and L, that the variable motion is obtained to suit the varying quantity of yarn on the pirns. The shaft, M, has keyed upon it a spur wheel, N, in gear with a pinion, O, upon a parallel shaft, P; upon which shaft is a spur wheel, Q, in gear with a pinion, R, on the upper central shaft, S, running along the entire length of the winding frame, being carried in suitable bearings in the transverse frames, A. The shaft, S, has fixed upon it at intervals a series of bevil wheels, T, which are in gear with and drive a series of bevil wheels, U, fast on the inner ends of a number of transverse horizontal spindles, V, disposed on opposite sides of the centre shaft, S, and revolving in bearings in the longitudinal frame bars, B. The spindles, V, each carry a pair of wheels, W, which serve for driving the winding spindles, X. One of these winding spindles is shown in longitudinal section in fig. 6, and it consists of a central iron or steel spindle, Y, which is covered with leather or other frictional material, Z. Each winding spindle, X, lies between, and bears by its frictional surface upon the peripheries of two adjacent pairs of wheels, W, the rotation of which causes that of the spindle and of the pirn, *a*, carried upon its outer end. The yarn or thread to be wound to the pirn or cop form, is brought to the machine in the form of hanks, *b*, mounted upon reels, or swifts, *c*, and the reels are supported in open bearings in brackets, *d*, standing out laterally from the framing. The yarns or threads, *e*, pass up from the reels, *c*, over a guide rail, *f*, and round the guide pins, *g*, to the pirns, *a*. The guide pins, *g*, are fixed to a longitudinal bar, *h*, which is traversed out and in by means of a heart movement, so as to lay the threads evenly along the pirns—the length of traverse of the bar, *h*, being exactly equal to the length of the cone on the pirn. The heart cams for traversing the thread guides, *g*, are fixed upon the shaft, M, at 1, there being a separate pair of hearts at each end of the machine; one of each pair being for each side. Each heart, 1, acts on a pulley, 2, carried by a bell crank lever, 3, which turns on a centre in a bracket, 4, fixed to the framing of the machine. The horizontal arm of the lever, 3, carries a weight, 5, which keeps the pulley, 2, up against the heart, 1; and the vertical arm of the lever is connected by a link, 6, indicated by dotted lines in fig. 1, to a rod, 7, capable of sliding through guides in the framing, and carrying the rod, *h*, to which the guide pins, *g*, are fixed. The outer end or cone of each pirn, *a*, lies between a pair of cheek pieces, *i*, which assist in shaping the cone, and in causing the build-up of the thread to be firm. As the pirn becomes full, it pushes the spindle, X, towards the centre of the machine, causing it to act on the lever, *j*, by means of which it becomes disengaged from the driving details.. The lever, *j*, vibrates on a centre at *k*, below, and it is formed with a short arm, *l*, upon which a weight, *m*, can be adjusted, thereby affording a means of regulating the pressure of the lever on the spindle and pirn. The lever, *j*, is arranged as represented on a larger scale in fig. 5, so as to act on a rod, *n*, the other end of which is jointed to a small upright catch lever, *o*, in front of the pirn. When the lever, *j*, is pressed back by the full pirn, it draws the rod, *n*, and the catch lever, *o*, so as to set free a spindle, *p*, above. This spindle, *p*, is capable of turning in bearings in the longitudinal frame bars, B, and it has fast upon it two segmental cams or eccentrics, *q*, and an eccentric weight, *r*, the latter being arranged so as to give the spindle a tendency to turn the cams to their most elevated position. These cams, *q*, are immediately below the winding spindle, X; and when the catch lever, *o*, sets the spindle, *p*, free, the cams turn on their spindle, and lift the winding spindle, X, out of contact with the driving wheels, W, so as to stop the communication to it of the winding motion. The catch lever, *o*, is made with a projecting thumb piece, *s*, by means of which the attendant can release the disengaging movement at any instant, as when the thread breaks, for example. Each individual winding spindle is fitted with similar disconnecting details, so that one or more may be stopped at pleasure without affecting any other portion of the machine. As the rate at which the spindles are driven varies according to the quantity of yarn upon the pirn, this variation being effected by means of the eccentric wheels, K L, as already described, the amount of driving power required will also obviously vary. This variation, however, is counterbalanced in the present machine by means of a weight, *t*, adjustable upon a lever or spanner, *u*, fast on the shaft, M, through which the driving power is transmitted. This weighted lever is so adjusted upon the shaft, as to act in concert with the power when more power is required, whilst it acts against or absorbs the power when a less amount of power is required.

Several of these machines are now in actual operation, and their working effect fully bears out what we have advanced in favour of the invention. Superior work, and a saving of time and waste, are points of gain completely realised in the example machine, which has afforded us the opportunity of remarking upon the scheme in the terms of our present article.

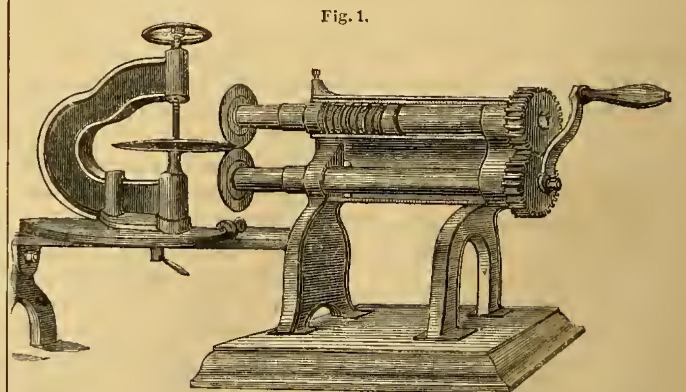
THE SOCIETY OF ARTS' EXHIBITION.

Coach-Builders' Photographs—Circular Plate-Cutting Machine—American Fog-Horn—Regan's Furnace—Locomotive Sanding Apparatus—Cramp Screw for Looking-Glasses—Crystal Window—Hand-barrow Ambulance—Self-Closing Tap—Jee's Continuous Rail—Bentall's Broadshare and Subsoil Plough.

The brief heralding notice of this show of the season, which was all we were enabled to give last month, hardly did more than tell the tale of the Exhibition's existence. Time has now permitted us to dissect the collection, and thus furnish the following explanatory chapter on its contents. We will begin with a subject which interests everybody—the practice of sun-painting.

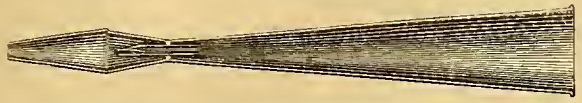
Messrs. Hooper & Co., the coach-builders of the Haymarket, have rendered an important service to the progress of photography, in its practical application to directly useful purposes, by bringing forward the process as a means of "readily producing perspective representations of carriages." It has long been a matter of great regret that this marvellous and exquisitely beautiful art should have been suffered to languish in its career towards a really solid usefulness, meeting with scarce any other employment than that of mere portrait-taking, and occupying a standing only on that debateable ground which lies midway between science and art, without fairly touching either. This position could not always be retained. A development must have sprung up one way or other. But it has done more. It has struck out shoots on both sides. In science, it has grown more scientific; in art, it has become more artistic. Hence we now find the art's range of usefulness to be slowly but surely widening, and one of the steps by which this has been accomplished is due to the forethought of Messrs. Hooper.

Fig. 1.



When they finish a carriage, and turn it out in all the plenitude of its accoutrements, they take a set of photographic pictures of it, and thus form a portfolio of reference. By obtaining a picture in accurate perspective, with every detail fully brought out, in a manner which would defy the highest powers of the best-skilled artists, the customers of the coach-builder—who, generally, can make nothing out of plain geometrical side elevations and working drawings—are enabled to judge of the actual effect of an equipage, before committing themselves to an order for it. But the camera, also, greatly assists the private operations of the coach-builder, for, after finishing any complicated or uncommon kind of carriage, he can in this way obtain a perfect representation of it, in all its parts and proportions; so that he can build an exactly similar one at any subsequent time—perhaps after the lapse of many years, when the details might otherwise have been forgotten.

Fig. 2.



The specimens of carriage photographs exhibited by Messrs. Hooper are both plain sun-pictures and coloured ones. They are executed by Mr. Herbert Watkins, and are charmingly done. One, which now lies before us, shows to perfection not only every minute detail of a town chariot, with its rich hammercloth, lamps, springs, and armorial devices, but also possesses a richness of effect, in its light and shade, far outrivalling all still-life calotypes which we have hitherto seen.

Fig. 3.

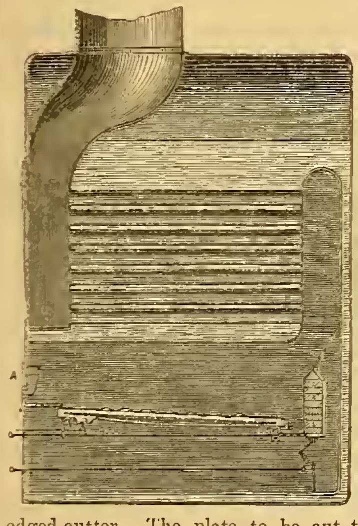
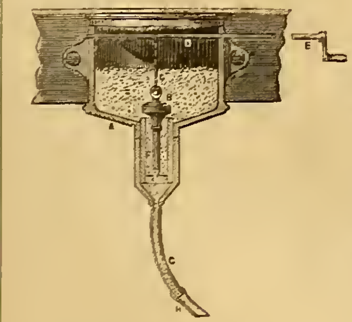


Fig. 1 is a perspective view of a "Circular plate-cutting machine," by Messrs. Sibley, of Ashton-under-Lyne, which we have already mentioned as a prominent article in the collection. The sketch represents the smaller hand-machine, as it stands upon a table. A pair of parallel horizontal shafts, geared together by equal-sized spur pinions, are made to revolve by a winch-handle at one end, whilst each shaft has at its opposite end a circular shear-edged cutter. The plate to be cut to circular form is clamped by a central screw in a recessed bracket holder, adjustable to suit the size of cut. The helix upon the upper cutter shaft is to allow of the necessary movement in cutting different thicknesses of plates. The makers have produced some larger machines of a similar kind for being driven by power, cutting from 6 inches to 6 feet in diameter, and capable of paring the edges of plates, as they come from the rolling-mill. They can cut either from the centre point, or from a hole in the centre. One now at work cuts ½ inch plates to 12 inches in diameter, in ten seconds.

Fig. 4.



Messrs. M'Naught & Wood, of Liverpool, contribute an "American fog-horn," copied from one brought by Captain Whitney, also of Liverpool, from the interior of America, where it is in use on the lakes, for signalling during dense fogs. The makers have also favoured us with a specimen horn, so that we are enabled to hear witness to its actual capabilities as a sound producer. The one we have is made of japanned sheet metal, shaped to the form represented in fig. 2, which is a longitudinal section of the instrument. It is about fifteen inches long, and has a narrow, slightly tapered mouth, opening into an angular swell, about two inches from the end. This swell is to afford room for the sounding tongue action. At the contracted neck, where the swell portion joins the main body of the tube, a little tubular brass case is inserted, with its full open end towards the horn's mouth. The other end of this case is duck's-bill shaped, and its flattened side has attached to it a free vibrating tongue, which gives the sound when the breath of the user is applied for the purpose. It produces a stunning sound with a mere zephyr breath; and when the full power of the chest is put on, an immense volume of sound is given out, far beyond what might be expected from so small an instrument. Its cheapness, portability, and power, should recommend it to all who "go down to the sea in ships."

Fig. 5.

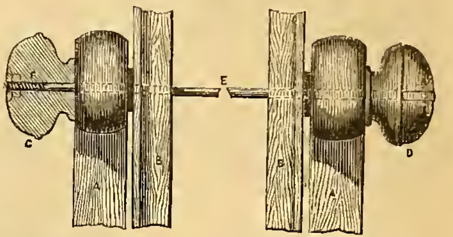
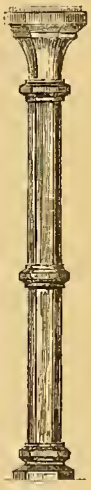


Fig. 3 is a section of a marine steam boiler, which we have ourselves designed in illustration of a "Smoke-preventing furnace, with moveable chill bars," by Mr. Regan of Liverpool. The object of this contrivance is to give a regulated supply of rarefied air to the gases of combustion. The external air is admitted through a chamber at A, attached to the fire-door, as well as through the dead plate, which is slotted for the purpose. The furnace-bars are of a composite kind, plain topped bars being regularly alternated with undulating ones. The plain ones are actuated for the prevention of clinkers, by a transverse action; and the undulating ones are shifted longitudinally. A perforated slide, or clinker-plate, B, admitting the air in front of the bridge, is placed at the back of the furnace, between the ends of the bars and the bridge, the front face of which is faced with bricks. In the plate, extending from it down into the ash-pit, there is also an adjustable valve, worked like the slide plate above, by a rod, passing to the front of the furnace. This furnace is said to consume its smoke in a successful manner, under several varieties of form.

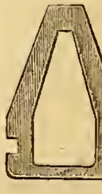
Fig. 6.



The "Railway sanding apparatus and driver's time-keeper," by Mr. J. Beall, of Cheshunt, is represented in fig. 4. It consists of a sand-holder, A, fixed to the engine-framing, and having a conical bottom, on which the sand rests. Within this holder is a valve, B, suspended by a cord, C, from a horizontal spindle, running along the side of the engine to the driver's foot-plate, where it is fitted with a handle, E, for turning it. The sand valve is of india-rubber, and its tail end is connected by an elastic piece, F, with a fixed cross-pin, so that the valve has a constant tendency to close. A metal pipe, G, forms the channel of conveyance for the sand downwards, where it terminates near the rail, in an india-rubber tube, H, which, whilst it prevents the scattering of the sand by the action of a wind, also prevents fracture in case of meeting with any obstacle.

The same inventor has also a "Cramp-screw for swing looking-glasses." This is represented in detail in fig. 5, which shows the two cramp knobs only, and a portion of the supporting standards, and the side pieces of the glass frame. A are the standards carrying the glass, and B the two sides of the frame. The knob, C, shown in section, has a flange nut set in it, to work upon the screwed end of the clamping spindle. In the other knob, D, the wire end is riveted in. E is the clamping spindle, or rod, passing right through the whole, and behind the glass; so that, by turning the knob, C, the glass can be set to work with any required amount of binding friction, thus avoiding that very common and annoying evil of a tumble-down glass, which the tormented user vainly endeavours to set right by sticking in pieces of paper, or any object nearest his hand, and capable of wedging up the frame.

Fig. 7.

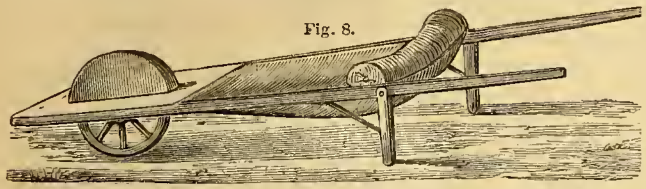


The "Patent crystal window," of Messrs. Lloyd & Summerfield, is a very elegant adaptation of glass to a new purpose—the framing pillars of large windows, such as shop fronts. Fig. 6 is an elevation of a complete pillar of this kind, and fig. 7 is a transverse section corresponding. Of course, wood engravings can convey very little idea of the beautiful reality of the original. Boxwood and printers' ink will not copy the wonderful hues reflected by such resplendent masses of artificial crystal. We can only give the contour, leaving the reader to examine the reality, of which there are now many examples erected in different parts of the kingdom. The chief fashionable street in Glasgow, we know, boasts of two large shop fronts of the kind, at the extensive establishment of

Messrs. Wylie & Lochhead, and at that of Mr. Graham. The London Mantle and Shawl Company, in St. Paul's Churchyard, has also a similar feature of attraction. These fronts consist exclusively of plate glass, supported by flint-glass pillars, or sash bars. Hence the transmission of light to the interior of the apartment is perfect; and whatever may be the risk from fracture, it is certain that they are imperishable as regards rust and decay. The larger pillars are made in detached lengths, which are bound together to form a single solid pillar, by a metal tension rod passing through the centre from end to end, and secured by screwing up. This binding rod is covered by a silvered tube, which materially adds to the lustre of the glass. A groove is cut along the entire length of the pillar, for the reception of the glass plate, which, when in position, is packed with a thin line of cement, hardly visible at a slight distance off. The sections of the pillars are of various forms, both hollow and solid.

Mr. F. J. Wilson, of Cadogan Place, Chelsea, is represented by no fewer than fourteen catalogue numbers. Some of these articles present but little novelty, and others are more ingenious and quaint than useful. The "Hand-barrow ambulance" deserves attention, were it only in reference to our Crimean war. Our sketch, fig. 8, shows that this contrivance is a simple barrow floor, with the wheel recessed into the floor, and covered with a sheet-iron cap. This shield prevents all chance of injury to the patient's legs. The greater portion of the floor consists merely of strong canvas, forming a soft bed for the recumbent body, the head having a pillow near the handles. If the wheel were furnished with springs, of course the action would be softened still further. Soldiers and policemen would find this contrivance very serviceable for the conveyance of the wounded to hospital.

Fig. 8.



The "Architect's pocket companion," by the same inventor, is a rule, compass, level, with pencil, penknife, compass point, and appropriate scales, all in one. The compass is in the rule joint, and the pencil and compound penknife and compass point are in the ends of the rule limbs.

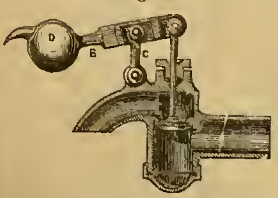
His "Cottage allotment subsoil fork," has a long handle bent to about two inches to the foot, out of the straight line, in the plane of the fork prongs. A small transverse handle is attached to this main lever, at about the usual height of a spade handle, on the side opposite to that to which the main lever is inclined. This enables the user to guide the implement into the earth. The prongs are straight, so that either the right or left foot may be used. When the prongs have been sunk up to the neck into the subsoil, the extreme end of the main lever is acted upon to bring a powerful lifting pressure upon the soil.

The "Hedge-slasher," or bill-hook, by the same inventor, is curved backwards instead of forwards, like the old hook. The cutting edge is thus convex, and the weight of the implement is thrown behind, giving a more satisfactory and steady blow in striking a hedge. As the cutting curve meets its work at an angle, it may be said to act by shaving. Mr. Wilson proposes to sharpen both sides, because the flatter the blade the more power is thrown into the stroke, and the back edge may be used when the other is blunt.

The "Machine for setting pencil drawings" is a simple contrivance for applying milk to the pencilling, by a roller action. A trough, about 18 inches by 3 inches, has a longitudinal roller sunk a little way into it, and made to dip into a thin stratum of milk in the trough. When a drawing is to be treated in this way, the roller is somewhat elevated for the interposition of the sheet beneath it. The roller is then again let down, and the sheet is drawn across beneath it.

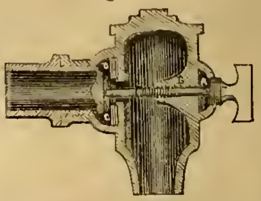
The "Self-closing lever tap or waste-water preventer," by Mr. George Davis, of Southampton, is a useful contrivance for town purposes, where a constant pressure service is employed. Fig. 9 is a sectional view of this tap, A being the valve disc regulating the flow from the straight branch to the main on the right to the curved discharge branch on the left. The spindle of this valve passes up through a stuffing-box in the chamber, and is jointed, at its free end, to the end of a lever, B, set on a jointed supporting link, C. The other end of the lever carries a ball weight, D, with a finger tail attached for lifting by, when water is required. On the removal of the finger, the valve closes very perfectly, and prevents all wasteful flow.

Fig. 9.



Mr. Barr, of Birmingham, has also a high pressure tap involving great security. Fig. 10 is a sectional view of this tap. The valve spindle is horizontal, and it enters the shell of the valve chamber by passing through a little cell stuffed with india-rubber, A. At B is a tapered boss piece, contrived to throw off the water as it rushes forward from the horizontal branch, in the expanded end of which is a leather washer, C, forming the valve seat. The greater the pressure of the water, the more secure will be the shut off.

Fig. 10.



Mr. Jee's "Continuous rail for railways," represented in cross section in figs. 11 and 12, under two separate forms, is simply a rail in two longitudinal halves or sections, fastened together by bolts or rivets, to produce a solid rail. The sections being so disposed as to break joint with one another, a continuous rail of easy action is secured.

Fig. 11.

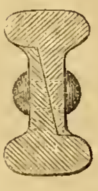
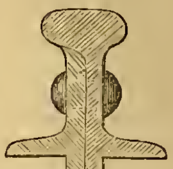
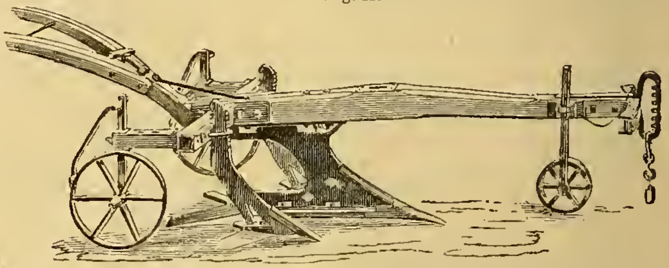


Fig. 12.



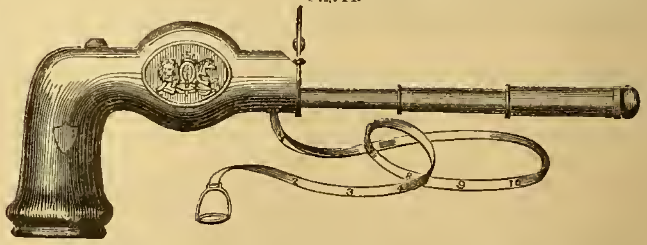
The "Broad share and subsoil plough," by Mr. Bentall, of Heybridge, is a most useful thing, which has made great way amongst modern agriculturists. Fig. 13 shows the plough complete. In ordinary implements of this class, the breaking up and paring of the soil demands two separate operations, which, with this contrivance, are accomplished in one.

Fig. 13.



Mr. Griffiths, of Wickham Market, Suffolk, has a pocket measurer for ascertaining the dimensions of horses and cattle with facility. This instrument, fig. 14, is made up of two parts, resembling a pistol and a spy-glass, the latter drawing out when required for use. It is contained in a case, 7 inches by 4 inches.

Fig. 14.



The safety lever bits, figs. 15 and 16, by the same inventor, have been devised for the purpose of giving the rider or driver increased power over the animal under his care. The first of our examples is for hackney, and the other for hunting purposes. They combine the curb and snaffle in one piece, and are rapid in action, both as regards holding and slacking.

Fig. 15.

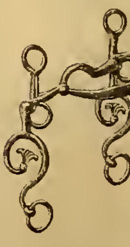
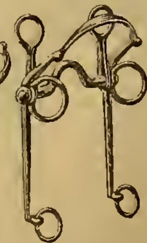


Fig. 16.



It is to be regretted that the catalogue has not preserved the attractive form and getting up of former years. The shape is not so good as before, whilst the illustrations, this year introduced for the first time, are badly executed, and carelessly printed. No doubt, the delay on the part of the exhibitors themselves, in furnishing their descriptive details, must be credited with a large proportion of the blame on this head. We hope that next year some better precautions will be taken for the prevention of this disagreeable feature. A good reliable catalogue, well and attractively illustrated, is half the exhibition.

THE ROYAL ACADEMY.

In maturing our opinion as to the merits of this year's exhibition at the Royal Academy, we are compelled to own that it is by no means of first-class order. No doubt, the popular addition which has been made in the way of the Fine Arts to the great store now or about to be opened at Paris has largely contributed to this effect. Many of our best men—Landseer, for instance—will be there, not here, this year. The paintings in Trafalgar Square cannot, therefore, with fairness, be compared with those which occupied their places in former times. For this reason, rather than deplore the general falling off in artistic merit, we should congratulate ourselves that our annual display is as good as it is.

The *soi-disant* pre-Raphaelites are largely in the ascendant as regards mere number; but it is to be deplored that the general character of their works this season partakes more of the laborious imitation of the Chinese, or the particular details of the microscopist, rather than that highest order of art which has now become gratefully familiar to us in the works of Mr. Millais and one or two others akin to him. First and foremost among the contributions of these gentlemen stands Mr. Millais' "The Rescue," a very fine production indeed. "The critic of art," says Lessing, as quoted in the catalogue for its motto, "ought to keep in view, not only the capabilities, but the proper object of art," and Mr. Millais appears to have borne this in mind in all his works, being not merely portraits. Perhaps it would be impossible to depict to the eye more forcibly the sublime sentiment intended by the artist—the salvation of the soul. A beautiful mansion is on fire; all its noble and costly appointments cannot save it from absolute destruction. With its own, it would have hurried along with it all that we consider the most innocent and guileless. But the all-powerful Redeemer is at hand, and with sympathy and staid compassion stamped in every feature, and simple dignity in every portion of his frame, the children, whose peaceful habiliments have partaken of the burning, are removed from the cunningly-contrived place of security, through the scarlet glare of the conflagration, into the arms of their loving parent. The story is painfully but exquisitely told, and we honour the young painter for its suggestion and art in him.

Our old acquaintance Roberts displays his talent in a very overgrown frame, by showing us the evening glories of Rome. Here and there are houses indeed, and trees, located to suit his purpose, rather than as they really are in the ancient queen-city; but we have the same fault to find as usual with his details, which, in scraps of sketches as they appear here, it is scarcely proper to call painting. None of the men admitted as masters in their profession did this. Such things are elaborate sketches, not pictures, and, exhibited by an academician, they operate as bad example. Contrast this (the only frame which Mr. Roberts has sent in) with the "St. Sebastian during the Siege of 1813," by Mr. Stanfield, R.A., every part of which is most carefully finished, not only without detriment, but with positive advantage to the general effect. This (545) is one of the best pictures which has come off his easel. "*El Pasco*" (68), the property of her Majesty, is a charming little picture of two Spanish ladies, by J. Phillip. Mr. M'Clise sends one painting only (78), "Orlando about to engage with Charles, the Duke's Wrestler," of varied merit, and having all his accustomed mannerism; as usual, rich in colour. "A Race" (182): some little boys, with younger ones on their backs, are on hands and knees gliding over the greensward of a village, as a diversion from a game of cricket. There is a pleasant truth and simplicity about this which enforces admiration. Mr. W. H. Knight has what might be a companion for it, "The Broken Window—who threw the stone?" "The Mitherless Bairn" (141), by T. Faed, is already a prime favourite. It is an exquisite cabinet painting, well composed, and in good colour. Mr. E. W. Cooke, A., comes as usual with some sea pieces. (269) "A North Sea Breeze on the Dutch Coast, Scheveling fishermen hauling the 'Pinck' out of the surf," is, we believe, the largest canvas he has painted, and well exhibits his many excellencies. The detail of the multifarious wares stowed in the boat, and which are exposed to view, is all admirably made out in every tittle while the surf has all the liberty which belongs to it. (323) By the same artist, "Scheveling Sands; low water, tide making in," is a gem of its kind. He is less successful in (645) "Winter; a scene on the fens of Huntingdonshire, old draining mills now disused." This picture assures us of the limited extent of artistic power, more than any other example that we now remember. His other picture (344), "Riva Degli Schiavone, Venice; fish arrived," is of far higher character, simply because it is in the artist's "vein." Happy is he, in every phase of life, who keeps within the bounds of his own power! "The Life and Death of Buckingham" (349), by A. Egg, A. (two pictures in one frame), brings to memory scenes which would better be buried in oblivion for ever. Why should the frailties and dark miseries of mankind be resuscitated? They are no proper object of art, which is to elevate at the expense of none dead or living. But we must hurry on. Mr. W. C. T. Dobson has a grand picture (379), "The Alms Deeds of Dorcas," most carefully painted, and claiming, from its subject and entire treatment, deserved attention. Mr. Danby's "Poet's Hour" (527) recalls, as it may do so, many associations of early hours which are always pleasant. It has less of his ordinary colouring, and is therefore better. Such a painting as this *does* carry out the object of art, however humbly applied. Mr. F. Leighton, a young artist hitherto unknown to fame, has startled the public with a large gallery painting (569) of an incident in the life of Cimabue, when his celebrated Madonna was carried in procession along the streets of Florence. We are delighted to hear that her Majesty has secured this work for £600. It is of far too high pretension and performance to allow us to say more, than that it is a surprising production of one so young. It is not always that a youth marks himself so enviably at once. He has received higher praise than this. We would ask him to beware, and heed nothing but the impulses of his own intelligent skill, as it shall be improved by correct criticism and honest reflection. (1141) "Old Schoolfellows," A. Rankley, is an affecting incident of domestic life, barely, if it really be at all, within the object of art. With respect to still life, we must confine our praise to Miss Mutrie's three very exquisite floral contributions (35, 304, and 1331). The Azaleas and Primula are all but growing. The examples in this line of other painters are all far below mediocrity.

It is always delightful to review these things; but a sound has lately gone forth into all lands of other forms of action and passion, and temporarily drowns them. It is not to be wondered at that the walls of the Academy should reflect this. War, war—lustful, revengeful, subtle as the serpent—has called up the "various thought" in our artists, and it is interesting to observe the many different forces which this tempest of discord has called to arms on their easels. When we paid our first visit to this exhibition we were accompanied by a young friend, who, very naturally, anticipated with us a sight of some of the incidents of the war. But here we have scattered about, in all directions, the whole of a soldier's life before us. It has been amusing to us to trace this in the catalogue and on the walls, and haply it may revive some sympathies in many of our readers if we now hastily run over what we collected in this way. "That happy place upon his Mother's knee" (501), which Mr. E. Havell has rendered so pleasantly, will still be remembered by the man, whether soldier or not. "A clever little dog" would exemplify the youth not many years afterwards. He is placed by his friends in a business. His sedentary duties become irksome to him, and the alluring fields of "Temptation" become open. He begins to absent himself at unusual and inopportune times. But the "Rescue" is at hand,—the stern but beautiful angels, "Affliction and Remorse," with their sometimes accompanying archangelic spirit "Repentance," arouse his consciousness, though as yet the "Valley of Humiliation" is far off. He is attracted by a "Recruiting Serjeant describing the Position of certain Troops," as of those at Inkerman—the scene effectively represented in 1356 by Mr. Bromley. He continues the constant attendant at "Family Prayer," and bears in memory a promise which accidentally came before him—"No weapon that is formed against thee shall prosper, and every tongue that shall rise against thee in judgment thou shalt condemn." But now has arrived the first great struggle in the life of his mind—what to do? The eternal shackling life of servitude before him to remain as he is—the hopefulness of something better, whatever it may be—anywhere, anywhere—but where? The army is the refuge. The bounty, too, has its intended enticement. Stealthy inquiries are made, and one bright morning—it may be the brightest—off he starts from home as to his ordinary occupation, and goes straight to where he knows the "Recruiting Party" is to be found. Some misgivings still prevail. His own years, he knows, are comparatively few. Some strings there are still untorn from his heart, and braiding him with home. He hesitates, avoids the gaze of the non-commissioned officer, and stands looking in at a window, but without knowing what he sees. The serjeant, interested in securing all the men he can, looks at him, passes him by as a boy not likely to be there for his purpose, but, as a *pis aller*, approaches and asks him if he wants to enlist. The matter is soon proceeded with. The word is put into his mouth, and he becomes such a recruit as Mr. W. W. Nichol has represented in 206. The serjeant, attracted by his bright youthful face, and having acquired the advantage of a knowledge of his actual position in society, tempts him still further; there is yet time to escape back to the bosom of his family and friends. This must be prevented—"Oh a fine young lad like you who can use the pen (imitating doing so) is sure to be made a corporal soon." Some days are allowed for reflection before the "Attestation" takes place—

> "An unconquered will
> Arises in his breast,
> Serene, and resolute, and still,
> And calm, and self-possessed,"

he passes through some "strange places," and some "darksome lanes and alleys," and becomes a soldier! But what about the loving ones at *home?* "The Parting Hour" (1348, E. N. Downard) comes, and the young recruit may think the wish, although he speaks it not, that when he is on

> "the other side of the sea,
> And fighting for his own country,"

sometimes, sometimes they'll think of him. His father, it may be, an only brother or an uncle who have known him from his birth, and have loved him tenderly, see him on his way to the railway to join the depôt of the regiment, each hoping a something he has not confidence enough to express in words, and silently pressing his arm with misty misgivings. He leaves them. He has left, too, one at home, the burden of whose silent song is constantly—

> "Thy angel I'll be—
> Through the furnace unshrinking thy steps to pursue,
> And shield thee, and save thee, or perish there too."

If the heart be beaming over with so beautiful an element as love, it has an infinite number of fields to display itself in, and he is happy who discovers them. All begin to love the soldier for *his* sake. It is begun to be thought an honour to be in the ranks; it is the greatest good that could have happened to him! thus alleging as a fact what she yearns to believe. See him in fancied future holiday costume, with all his honours thickly studding his breast!

But "the dream is short, the sorrow long." It does seem really wonderful that mere barren wilfulness should cause so much distress, and be permitted at pleasure to sound the frightful tocsin, and even to contribute to its minutest power.

The "Council of War" has begun to have its magnificence and mystery for him. He may be on another "Alma," or in a "Glorious Charge of Heavy Brigade," as at Balaklava, which is here given by Mr. H. C. Selous with good effect. Now he is "Repelling the Cossacks" (187); now in "The thick of the Conflict" (168). A change comes on; we may find him now in the hospital at Scutari—a scene which has attracted Mr. D. Y. Blackiston's careful pencil. When the mournful authenticated news comes in the pages of the *London Gazette* of the casualties of the fight, what changes take place in its readers! Hope and fear interchange positions, and perhaps both may be resolved into deepest grief, as in the young mother in Mr. Cope's "Consolation." Here is a letter "From our especial Correspondent" (152, T. Faed), bringing news interesting beyond the dry dispatches. We have here, too, anticipated early "The Breaking-up of the Camp" (1319, J. Cormack). This may be the utmost of good that the young soldier can hope for, and return home. He may not return, but be buried a stranger among strangers. He may return, but be disabled from all service to his country or himself. Whether the war end or not, after all his "adventures," which were so anticipated in his boyhood, ere his youth had passed through the "strange places" and the "darksome lanes and alleys" into manhood—on the expiration of his years of contracted service, of which he has now become heartily tired, the wanderer returns home, and, like the young mother in Mr. H. O. Niel's affecting contribution (393), finds more than one heart broken, which had begun to break when he broke up his home so suddenly.

We have, of course, the usual series of portraits of celebrities, whose features it is always interesting to be personally, or by representation, acquainted with. Without adverting to their respective merit as works of art, we would merely mention some of them as they occur in the catalogue. Lord Dunfermline, Sir Robert Harry Inglis, Lord Brougham, the Chief Justice of the Common Pleas, Captain M'Clure, Sir William Molesworth, Sir Edwin Landseer, Richard Owen, Robert Brown, our always acceptable friend H. B., John Gibson, Horace Vernet, Eliza Cook, Lord Lyndhurst, and William Yarrell, are placed before us as they live—and a short list is this of honourable men. The small but excellent portrait of Professor Owen, by Mr. G. T. Doo, is particularly noticeable, as being an excellent likeness.

There are, this year, few pieces of sculpture, or even of modelling, claiming attention. (1410) "Child Play; marble group; the children of Herbert Ingram, Esq.," by A. Munro, is an exception. We envy the possessor of so charming a picture of infantine life.

AMERICAN NOTES.

BY OUR OWN CORRESPONDENT.

The American Crystal Palace—The *Ericsson* and *William Norris* Steamers—The Vanderbilt line of Steamers—Turpentine and Oil Lubricant—Cotton Press with Self-adjusting Action—Injection Water Regulator for Condensing Engines—India-rubber Lining for Vessels—Railway Carriage State-Rooms—Disbrow's Railway Truck—Uhry and Luttgens' Link Motion.

The Crystal Palace building still remains untouched, and contains all, or nearly all its original stock of paintings and statuary. Only two or three watchmen are retained in lieu of the hundred and fifty previously employed, and the expenses being thus trifling, and the receipts at the door, which is still open for visitors, being represented as near 100 dollars per diem, the speculation is now working far better, in a financial point of view, than at any previous period.

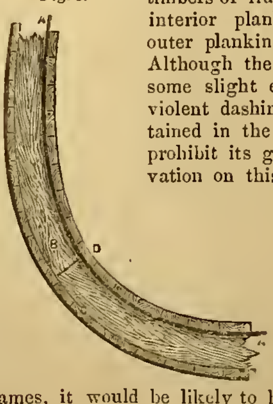
The hot-air ship *Ericsson* lies at her dock apparently quiet. The six-day steamer *William Norris* is advertised every day for sale. The war steamer *Niagara*, the largest of the six lately contracted for by the government, is being pushed rapidly forward at the New York navy yard, and the new line of steamers owned by Mr. Vanderbilt has just commenced running between New York, Liverpool, and Havre. Business, generally, is excessively dull, although a little improving within the month or two last past.

The "Howe rig," of which an illustrated notice was some time ago given in this journal, has been adopted on a still increasing number of large ships, and is by this time probably familiar to the nautical reader. Its moderate first cost is probably the chief, if not the only reason for its popularity over the "Forbes rig," with which it was then compared.

Among the recent patents worthy of a brief notice, is one for mixing crude turpentine with fixed oils for lubrication, a measure which would seem to be anything but beneficial; one for adapting the power of a cotton or other press to the resistance, by providing cone pulleys, and causing the belt to assume a position thereon, changing with the increase of resistance; one for regulating the quantity of injection water for a condensing engine, by the aid of a small cylinder opening into the condenser, so that, as the vacuum becomes perfect, the amount of injection shall be decreased; one for making paddle wheels more readily adjustable in regard to diameter, by racks and wheels on the arms, to allow of "reefing" the paddles in any weather; and one for a peculiar method of securing to the flukes of anchors additional broad, thin flukes, when desiring to ride out a gale on a light sandy anchorage. In matters of minor importance, one inventor has constructed a lancet with a charger and piston inside its blade, for injecting the matter in vaccinating before withdrawing the blade from the flesh; another has fitted brushes at the sides of an ordinary door-scraper, the brushes being pressed against the foot by springs, so that the sides and sole of the shoe are cleaned at the same time; and a third has connected to the valves by which fresh air is admitted to a room, a self-acting regulator, consisting of metallic rods, which contract as the temperature falls, and so open the valves.

Mr. V. P. Corbett, of New York, has patented, and is now making efforts to introduce, a plan of lining vessels with a continuous coating of india-rubber as a safeguard against leakage. Fig. 1 represents a portion of the side of a vessel seen in section; B being the timbers or frames, C the exterior planking, and D the interior planking. It is customary to caulk the outer planking tightly, and depend upon this alone. Although the inner planking is usually caulked to some slight extent, it is merely to prevent the too violent dashing and spirting of the bilge water contained in the spaces between the frames, and not to prohibit its gradual admission. Mr. Corbett's innovation on this style of building, a style which has probably been in use ever since the old patriarch pitched the ark "within and without with pitch," may tend very much to reduce the risk, as it will considerably relieve the ship from the liability of leakage. In the figure, A represents the lining, which is introduced between the frame and the ceiling. If located exterior to the frames, it would be likely to be much strained and ruptured by the

Fig. 1.



hydrostatic pressure, which would force it in between the frames; but in its position as in the figure, it is continuously supported by the planks of the ceiling, and is subject to little damage from any cause.

A large proportion of the accidents which occur to the hulls of vessels, are from striking the bottom in such manner as not to actually displace, or rather to destroy any portion, but only to strain and split the wood. The whole reliance being on the integrity of the exterior shell, it follows that the starting of a few planks creates a furious leak, and unless the pumps are capable of controlling the evil, the ship is lost. With Corbett's gum lining, the leak merely fills the spaces between the frames, and the interior of the hold remains as dry as before. The edges of the sheets, which are proposed to be from ¼ to ¾ of an inch in thickness, are to be cemented by heat, and the gum is believed, by those familiar with its qualities, to be as durable as the wood itself.

One of the most novel, and at the same time evidently practicable suggestions for increasing the comfort of travellers on a long journey by rail, is that of fitting up state-rooms, and letting the use of them to passengers on the payment of an additional sum. On the long routes in this country, it is no unusual thing for a gentleman to spend three, four, or even five days and nights in continuous travelling. In the winter season, the lakes and rivers are frozen, and the travelling in the Northern States is entirely by railroad, and even these are frequently encumbered by snow, so that the journey is still further protracted. The detention of one train for 20 successive days on the railroad between the Mississipi River and Chicago, is an extreme case of this kind, and may render the past winter ever memorable in the annals of railroad travelling. The suggestion is to attach to every night express train on a long road, an extra car built for the purpose, which shall be in whole or in part divided up into state-rooms, where the passenger, by paying an additional dollar or more, may recline at ease and sleep soundly until morning. But, perhaps, one of the most marked improvements in the comfort of railway carriages yet to be noticed, is the "broken truck" device recently patented by Caleb R. Disbrow, of Bath, N. Y., and put into practical use on the Buffalo, Corning, and New York Railway. This truck distributes the inequalities of the road to a still greater degree than any other, and, consequently, rides much easier; and is so arranged, that each wheel is independent of its mate, a desideratum of considerable theoretical importance in turning curves, as the outer wheel in such situations travels along a longer rail, and, consequently, seeks to revolve more rapidly than the inner one. It follows, from both these causes, that the truck itself will be more durable; and the percussive effect on the truck being diminished by dividing more equally the effect of each inequality, the rails will be far more stable and enduring. In short, the truck promises to obviate much of the "wear and tear" which has always been such an objection to the maintenance of high speeds in railway trains. Fig. 2 is an elevation, and fig. 3 a plan of the improved truck, which somewhat resembles a common truck divided by a longitudinal line through its centre. Each half-axle, D, has two boxes, C, one at each extremity, so that the whole number of boxes in each truck is eight, instead of four. The only connection between the two halves of the truck is by the extra axle, E, which does not require greased bearings, so little is the play. The bolsters which receive and sustain the weight of the car, also extend quite across, the greater portion of the weight being sustained by a pin at the centre; but a portion being allowed to rest on "rub-irons" at the sides to maintain the equilibrium, being in this respect precisely like ordinary carriage trucks. It will be seen that each half of the truck is free to oscillate vertically; and in fig. 2, the wheels are represented in the act of thus riding over an obstacle. The rub-irons, B, are provided to maintain the proper distance of the semi-trucks, and also to preserve their parallelism. Under this arrangement, each wheel bears its proportion of the weight, and is of course provided with the ordinary springs between the axle boxes and the truck frame, whilst a vertical movement of any one wheel disturbs neither of the other three in its degree of pressure upon the truck.

Fig. 2.

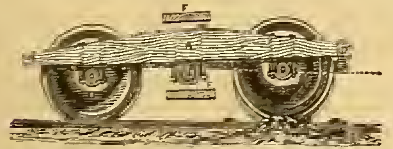
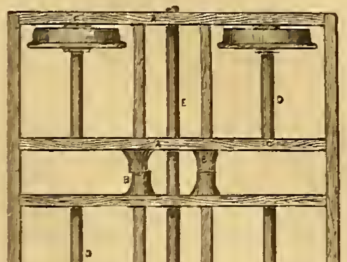


Fig. 3.



Messrs. H. Uhry and H. A. Luttgens, of Patterson, N. J., have lately introduced an improvement on the link motion for slide valves, which may be of considerable importance to English engineers. In America, all marine and river boat engines, except screw propellers, use poppet valves; and although the great majority of horizontal stationary engines employ the slide valve in some form, and in a great number of cases regulate the speed by changing the point at which the admission of steam is cut off, the link motion has never yet been applied to this class of engines. Its use is confined entirely to locomotives, and for this great class of engines its simplicity and convenience eminently adapts it. But it has always been objected, that in this device, at high grades of expansion, the steam is considerably wire-drawn in entering the cylinder, and is allowed to escape too early, although prevented from completely escaping as the piston returns.

The improved engine has two valves and two sets of ports, one for the steam, and the other for the exhaust. In short, each cylinder has two distinct faces, one for each valve, as represented in fig. 4; both of the faces, and the valves which slide on them, being covered by one steam chest. F is the steam valve, which is merely a flat plate, the steam face having but two ports. The exhaust valve, represented by H, is precisely like the common "short D" slide valve, except that there is an extraordinary amount of outside, and but little inside lap. The steam valve is worked by the ordinary link in the usual manner, but in giving motion to the exhaust valve, an additional device is employed, which is represented in figs. 5 and 6. It consists chiefly of an additional link, or rather a slotted lever, C, which has its fulcrum at G, near the extremity of the arm of the rock-shaft. Its fulcrum, therefore, receives very nearly the same motion as the steam valve. To one extremity of this lever is connected the stem of the exhaust valve, and the other extremity, or rather a link-block which may be moved in the slot so as to extend the other arm of the lever to any desired length, receives motion from a third eccentric, a motion which corresponds exactly with that of the crank, so that its action is the same whether the engine is going forward or backward. When, by the action of the additional adjusting lever, E, the lever is shortened to the utmost, as in the drawing, fig. 7, the effect of the improvement is greatest, and results in holding back the time of exhaust till about the end of the stroke, and then keeping the exhaust open till the return stroke is very nearly completed. American locomotives, unlike English engines, employ only from ⅝ to $\frac{11}{16}$ inch outside lap, and the evils of "small steam ports, early exhaust and early compression at high grades of expansion," are more aggravated in consequence.

Fig. 4.

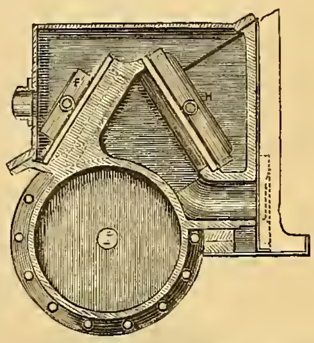


Fig. 5.

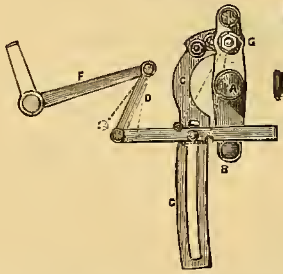


Fig. 6.

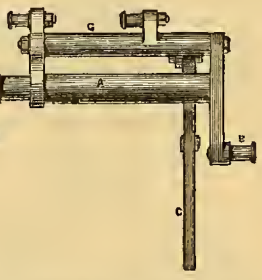
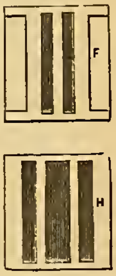


Fig. 7.



The improvement gives a great control of the link motion, and improves its working when starting at full stroke, as well as when cutting off short at high velocities.

Taking the present practice of locomotive builders in this country, which is about the practical limit of the ordinary link motion, the steam is cut off at eight inches at the highest grade of expansion; in which case, compression commences at 12½ inches, and exhaust commences at 17½ inches, the stroke of the piston being 22 inches. The improved link motion, on the contrary, cuts off at 4 inches, and compression and exhaust are both delayed till 20 inches, the opening and closing being quick, and wire-drawing the steam but slightly. In working at full stroke with the improved arrangement, the steam valve closes at 16½ inches; but in this case, the exhaust valve receives sufficient throw, so that, in spite of its great lap, it serves as a steam valve, and continues to admit steam until 19¾ of the 22 inches are completed. The opening of the steam port, which is on the common link motion only $\frac{7}{16}$ inch, is in the improved form ¾ to ⅞ inch, thus leaving sufficient opening for the highest grades of expansion; in which condition this improvement is most effective, and effects a saving, theoretically, of nearly 50 per cent. of steam.

SCHEUTZ' CALCULATING MACHINE.

Considerable interest has already been excited by this remarkably ingenious invention, recently patented in this country by the inventors, Messrs. Scheutz (father and son), of Stockholm; and whilst we can confirm what has been said in its praise, we doubt not our readers will thank us for laying before them some of the mechanical ingenuities which it comprehends. The machine is of the class known to mathematicians as difference engines, and is adapted for calculating tables, the formation of which involves the successive addition of particular differences. The machine, being set to the law of the particular table to be calculated, is made to work by turning a handle, and requires the application of a very little force for that purpose.

Fig. 1 of our illustrations represents a full-sized front elevation of two of the calculating wheels of the machine, with the immediate mechanism for actuating them. Fig. 2 is a plan of one of the calculating wheels, and fig. 3 is a plan of the "trap," or apparatus for engaging the calculating wheels. Each calculating wheel, A, is formed with as many studs or teeth, B, on its under side, as there are figures in the numerating system to which the apparatus is adapted. Thus, in the sexial system, these wheels would contain six studs, for the figures, 0, 1, 2, 3, 4, and 5; or, in the decimal system, ten studs, for the figures, 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.

The wheels are each marked with the figures corresponding to the number of studs or teeth which they contain; and they are arranged in horizontal rows, in such a manner that all the wheels which, during the action of the machine, represent terms in the same series, lie in the same horizontal lines. The calculating wheels consist of open rings, detached from any central spindle; and they rotate independently of each other, each within a fixed ring, or portions of a ring, C, screwed to plates, D, which form a portion of the frame. Enclosed in these rings, the calculating wheels are moveable in either direction by hand, and can be set so as to present any desired figure in front or behind, two series of wheels being employed, one set in front, and the other immediately behind. When the machine is working, the alternate rows of wheels are alternately in motion and at rest, the alternate and intermediate wheels moving in opposite directions. Each wheel, excepting those in the top row, which represent the tabular numbers, or calculated products, is fitted with a semicircular catch lever, E, working on small stud centres, F, fitted inside the wheel. This catch is for the purpose of bringing into action the engaging "trap," G, above it, and represented in detail plan at fig. 3.

Fig. 1.

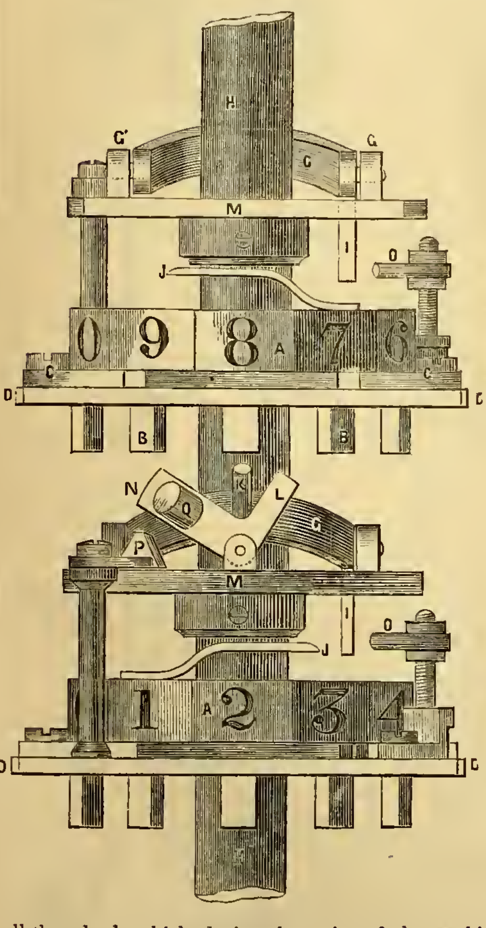
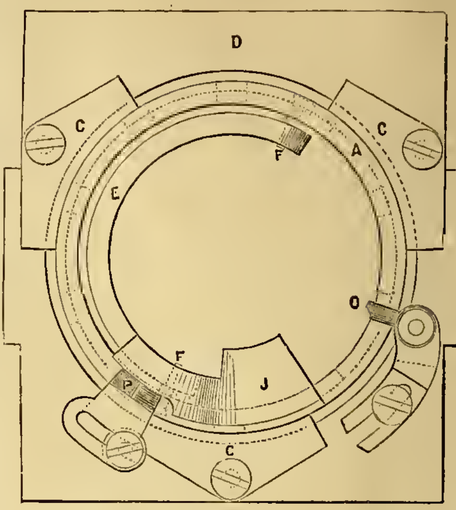
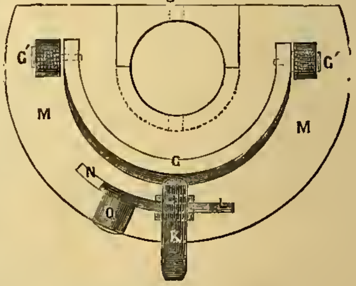


Fig. 2.



There are five calculating wheels in each vertical column, and each of these wheels, with the exception of the top one, which represents a tabular number, has a trap, G, placed above, and working in connection with it. Each trap works on centres at G', carried by the vertical spindle, H, which is made to rotate alternately in each direction by a rack and pinion movement. All the traps, consequently, rotate simultaneously with the vertical spindle, H, which, passing up through the calculating wheels, revolves without touching them. As each trap rotates, a pendant arm, I, attached to it, comes in contact with the raised portion, J, of the catch lever, E. And when the rotation is in one direction, the arm, I, of the trap, depresses the tail, J, of the catch, and passes it without further effect; but when the trap rotates in the opposite direction, the end of the tail, J, by coming in contact with the pendant arm, I, of the trap, causes the trap to tilt, and bring the stud, K, attached to it, upon the top of the trap-holder, L, which is hinged to the plate or disc, M, of the trap, and is brought into a vertical position by the descent of its longer and heavier arm, N. The catch, J, causes the elevation of the trap stud, K, whenever the calculating wheel represents a valid figure, during the movement of the trap; but when the wheel represents a zero, the tail, J, is pressed down, by passing under a fixed stud pin, O, when the tail, J, of the catch, E, will no longer be in a position to act on the pendant arm, I, of the trap. When the trap is raised, it elevates the stud, K, into the space between two of the studs or teeth, B, of the calculating wheel immediately above it, and causes this wheel to turn to an extent corresponding to the portion of the revolution of the spindle, H, still to be performed on the engagement of the trap, this depending on the position of the wheel below.

Fig. 3.



At the termination of each revolution of the spindle, H, all raised traps are at once restored to their position of inaction, as shown in the illustration, fig. 1. This simultaneous release of such of the calculating wheels as are engaged by the traps is effected by a double incline, P, fixed over each wheel, in such a position as to act on a short stud or pin, Q, on the longer arm, N, of the trap-holder. As the trap comes round, the arm, L, of the trap-holder is thrown out of the perpendicular by the action of the pin, Q, on the incline, P, releasing the stud, K, and allowing the trap to descend. The stud falls down between the two arms, L and N, into the position in which it is represented in fig. 1, and becomes quite clear from the teeth or studs, B, of the wheel above it.

Each calculating wheel, except those in the last column to the left, and those in the lowest row, is fitted with a tooth, R, which is shown in the plan, fig. 4, and is so placed as to actuate the arm, S, of a horizontal lever, T, whenever a zero is expressed by the wheel. The other arm of

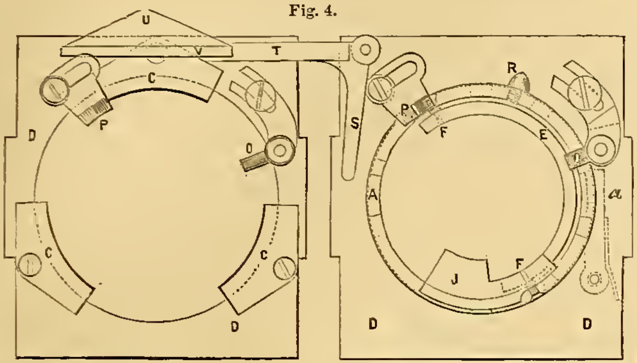


Fig. 4.

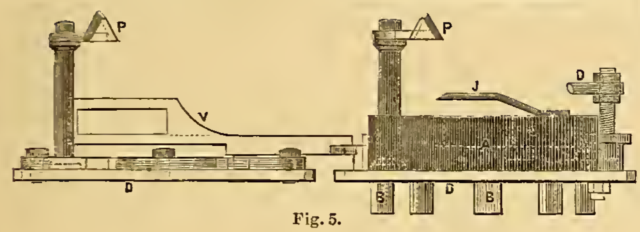
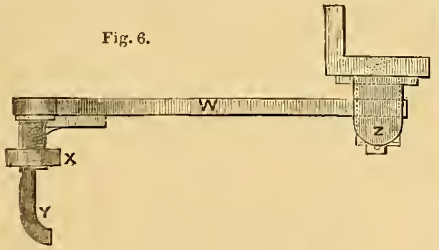


Fig. 5.

this lever extends in front of the calculating wheel in the next column, and is formed with a horizontal and vertical incline, U and V, as shown in figs. 4 and 5, which represent respectively a half-sized plan and elevation of the apparatus. When the tooth, R, comes in contact with the arm, S, of the lever, the inclines, U and V, are brought slightly forward, or are made to move outwards from both the front and back series of calculating wheels. In this position, the inclines are acted upon by an arm, W, which is represented in plan in fig. 6; fig. 7 being a side elevation, and fig. 8 an end view of the same detail. The arm, W, is fitted loosely on a pillar, which traverses in a groove in front of the calculating wheels, both the front and back series having a similar pillar, with arms traversing in front of them, but moving in opposite directions. One of these pillars carries an arm, W, for each alternate row of calculating wheels, and the other pillar carries similar arms for the intermediate rows of calculating wheels, the bottom row excepted. Each arm carries a small anti-friction roller, X, which comes in contact with any of the vertical inclines, V, which may have been pushed forward; and by this means the arm is slightly elevated during the passage of the roller over such incline. By this raising of the end of the arm, W, a catch, Y, fitted thereto, is brought into gear with the studs, B, on the calculating wheel behind the incline, V, and causes it to remove a single tooth, corresponding to a unit. The horizontal levers are pushed in, and restored to their original position by the horizontal projection or incline, Z, on the pillar which carries the arms, W, such projection, or incline, pressing against the horizontal incline, U, on the lever, T. In order that the calculating wheels may never move beyond their proper distance, a small spring click, or detent, *a*, is caused to bear against the sides of the studs, B, as shown in fig. 4.

Fig. 6.



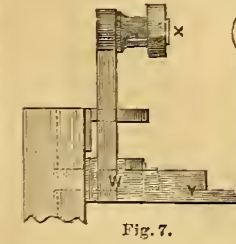


Fig. 7.

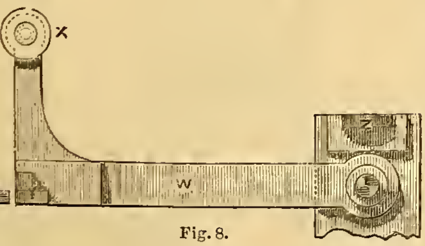


Fig. 8.

This completes our description of the main details of the calculating mechanism; but the apparatus not only calculates, but is also provided with a means of printing each result, or of impressing it upon a piece of lead, from which a stereocast can be taken, for the purpose of printing any number of copies. A machine, which the inventor submitted to our inspection, is constructed to calculate to sixteen figures, being, however, arranged to print only as far as eight figures; and a very ingenious but simple contrivance is introduced, for adding a unit to the last figure, when the ninth figure would be five, or more. We shall probably take an early opportunity of illustrating and describing the printing, or self-recording mechanism, to which we have referred.

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RECENT PATENTS.

COTTON-SPINNING SPINDLES AND FLYERS.

T. Shaw and R. Dickson, *Preston.—Patent dated October* 11, 1854.

By means of the contrivance comprehended in this invention, greater stability is given to the spindles and flyers of slubbing, roving, and jack frames employed in spinning cotton and other fibres. This contrivance consists of a detachable stay or lever for steadying the upper end of the spindle and flyer, this stay being jointed to a rod carried by the framing, and having a bush or bearing in its free end, in which the flyer revolves.

By this means, the vibration caused by the rapid motion of the machine is greatly modified or reduced, and, consequently, a much higher speed may be employed without detriment to the article produced. The stay or lever is used also to lift the flyer off the spindle when the bobbin has to be removed. This is effected by having all or part of the stays or levers in the machine jointed upon a single rod running the entire length of the machine, so that, by raising or turning this rod at one or both ends, the whole of the flyers can be raised together, instead of singly as at present. An arrangement is, however, also made for raising each stay or lever singly and independently of its neighbour when requisite.

Fig. 1 of our engravings represents a side elevation of a detaching stay or lever as applied to the spindle and flyer of a slubbing frame, and

Fig. 1.

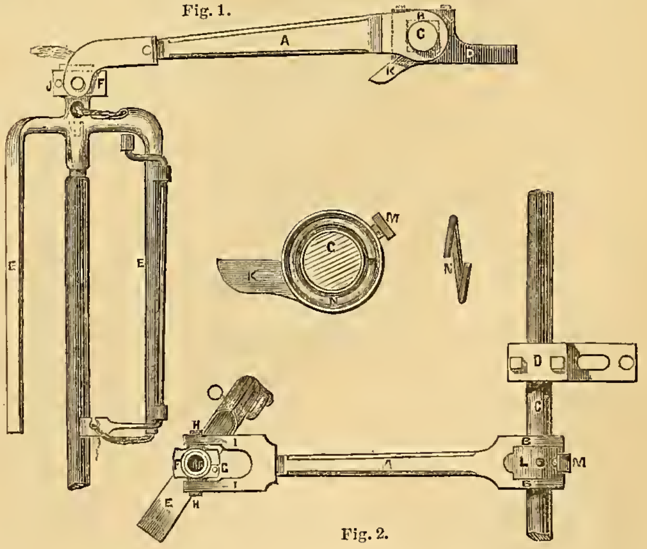


Fig. 2.

fig. 2 is a plan of the same. The detaching stay or lever, A, works by a fork-joint, B, on the rod, C, running the whole length of the machine, and supported in bearings in brackets, D, attached to the beam of the slubbing, roving, or jack frame. The lever, A, rests by its free end on the top of the flyer, E, which has a journal formed upon it to revolve in the bush, F. This bush is made in two pieces, jointed or hinged together at G, and carried on pivots, H, between the forks, I, of the free end of the lever. By this means, the top of the flyer is held steady and firm during its rotation, at whatever speed it may be driven, without the vibration hitherto found so obnoxious; the bush, F, may be tightened up when requisite by the transverse screw-pin, J, so that the top of the flyer may work therein without jarring or vibration. These stays or levers are used also for lifting off the flyers from the spindles when the bobbins have to be removed. This may be effected by partially turning round the rod, C, which, by means of the tail pieces, K, fixed thereon, will have the effect of raising the whole of the stays or levers simultaneously. In order to admit of each stay being raised singly, the stays are all jointed loosely on to the rod, C, by the forks, B. The central boss, L, shown detached, and drawn to a larger scale, is made fast on the rod, C, by a small set screw, M, or other convenient arrangement, and on the boss is formed a tail, K, which bears against the under side of, and raises the levers or stays, A. A ring groove, or recess, is formed in each side of the fixed boss, and into this groove is inserted a single coil of a spiral spring, N, also shown detached. These two springs tend to press against the inner sides of the fork, B, which embraces the boss, and by this means a certain amount of friction is produced, which serves to hold up the lever, or keep it elevated after it has been raised, until it is again pressed down by the attendant.

TREATMENT OF AURIFEROUS ALLOYS OF TIN.

Dr. A. P. Price, *Margate.—Patent dated June* 22, 1854.

This patent comprehends various chemical processes to be adopted in the treatment of alloys of tin and gold, or of tin containing gold and silver with copper or lead, for the purpose of obtaining commercially valuable products therefrom, and of separating therefrom the precious metals, which may be subsequently treated so as to produce useful products in the arts. According to one process, certain alloys of tin and gold, more particularly that known in commerce as Australian auriferous tin, is subjected to the action of hydrochloric acid, so as to dissolve the entire or the greater proportion of the tin, which solution of chloride of tin may, by evaporation and crystallization, be rendered suitable for employment in the arts, or it may be converted into any other useful product. The residue, after the action of hydrochloric acid has taken place, will contain gold, mixed sometimes with a certain amount of tin; and, should the alloy previously have contained such metals as copper, silver, or lead, then they will, in part or entirely, be also found in the residue, as also arsenic, antimony, or tungsten, if these last have likewise been present. The gold may be separated from this residue by boiling with nitro-hydrochloric acid, and it may be separated from solutions so obtained by means of protosulphate of iron, oxalic acid, or by any other suitable mode. The silver remaining as chloride of silver after the separation of the gold by means of nitro-hydrochloric acid, may be reduced, in the ordinary manner, by means of metallic zinc or iron and sulphuric acid, or the chloride of silver may be dissolved out by means of ammonia, or by any of the known solvents of chloride of silver, or it may be otherwise treated. Should lead have been present in the alloyed tin, that portion which has been dissolved may be separated from the solution by means of sulphuric acid.

The improvements further relate to the treatment of tin containing gold, as aforesaid, with nitro-hydrochloric acid, so as to obtain a useful product, known in the arts as nitro-muriate of tin, or bichloride of tin, and to separate and obtain the gold contained in the said auriferous tin. The tin containing gold is dissolved in a mixture of nitro-muriatic acids, and sufficient hydrochloric and nitric acids are to be employed to convert the amount of tin dissolved into bichloride of tin; should any of the gold have been dissolved during the operation, then a solution of protochloride of tin is to be added until the gold is precipitated, or metallic tin may be dissolved in the solution in such quantity as to effect the precipitation of the gold. The gold, either remaining undissolved or precipitated either as purple of cassius or otherwise, may, after separation from the solution of bichloride of tin, be dissolved in nitro-hydrochloric acid, or in any other solvent, and may be precipitated from the solution by means of a suitable reducing agent, such as protosulphate of iron; should any silver have existed in the alloy or mixture, the chloride of silver remaining may be separated in the manner before mentioned, and any lead that may exist in solution may be separated as before mentioned, by means of sulphuric acid; or the residues containing tin and gold, either together or alloyed or mixed with copper, silver, or lead, may be fused with sulphide of antimony in a manner similar to that for separating tin from gold, and the resulting alloy may be treated by any of the known or suitable processes for separating antimony and gold, either alone or alloyed with silver, copper, or lead, or the residues containing gold may be otherwise treated.

Further improvements relate to the treatment of tin alloyed or mixed with gold or silver, with nitric acid, so as to convert the tin into an available product, namely, binoxide of tin; and in subsequently treating the binoxide of tin thus formed with nitro-hydrochloric acid, or with chlorine in solution, so as to dissolve the gold remaining with the binoxide of tin; and the solution of gold thus separated from the larger proportion of the oxide of tin may be precipitated, either by means of a solution of protosulphate of iron, oxalic acid, or by means of metallic tin, or otherwise. The silver existing in solution in the nitric acid may be precipitated as chloride of silver by means of hydrochloric acid, and any lead that may be in solution may be precipitated by means of sulphuric acid or any of the residues containing gold, from which the whole or the greater proportion of tin has been separated by the action of hydrochloric acid; or nitric and hydrochloric acids may be alloyed with lead, and the lead be separated, together with other impurities, by cupellation, as is well understood.

In carrying out this invention, when hydrochloric acid is employed as a solvent for the tin, vessels similar to those now used in the manufacture of chloride of tin may be employed; when mixtures of nitric and hydrochloric acids are employed, or when nitric acid alone is used to convert the tin into binoxide of tin, stoneware or other suitable vessels may be substituted.

THREAD OR YARN WINDING MACHINE.

J. H. Johnson, *London and Glasgow.*—(L. J. N. Carpentier.)

Patent dated June 30, 1854.

M. Carpentier's apparatus is more especially designed for winding silk, but it is also applicable to the winding of other kinds of yarn or thread. The improvement consists principally of a contrivance for crossing the threads during the winding process, in such a manner that the completed skeins will resemble the figure 8, each alternate thread or convolution of the silk crossing the centre of the figure in opposite directions. This crossing of the threads is obtained by giving a suitable reciprocatory motion to the thread-guides as the thread is being wound.

Fig. 1 of our engravings is a front elevation of a portion of a winding machine arranged according to the improved system, fig. 2 is an end elevation of the machine, and fig. 3 is a view of two completed skeins turned in different directions. The winding details are carried in a wooden framing, A, and consist of a three-bladed reel, B, one of the blades of which is contrived to draw in after the thread is wound upon it, so that the skien may be easily removed. The spindle of the reel, B, has a pinion, C, fixed upon it, in gear with a spur-wheel, D, carried upon a stud-pin bolted to the framing. The spur-wheel, D, is in gear with a spur-wheel, E, on a horizontal shaft, F, upon which is fixed a scroll barrel, G,

Fig. 1.

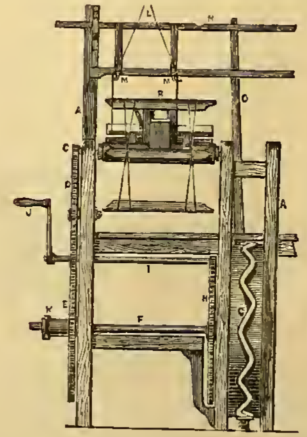
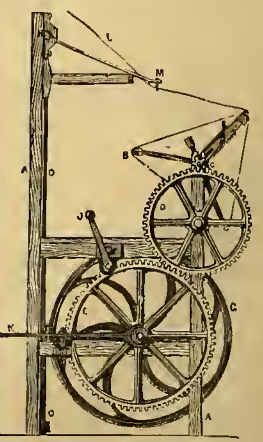
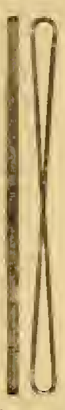


Fig. 2.



for effecting the reciprocation of the thread-guides. The shaft, F, is driven by means of a spur-wheel, H, fast upon it, and in gear with a pinion on a shaft, I, which is fitted with a winch-handle, J, for turning it by. The shaft, F, passes through to the other side of the machine, not represented in the figure, and drives another reel or set of winding reels on that side of the machine. Either of the reels may be set out of gear without affecting the other one, by shifting the spur-wheel, E, by means of a clutch and lever, K, out of gear with the spur-wheel, D. The threads, L, to be wound, are guided to the reels by the hooks, M, which are carried on a sliding-bar, N, and this bar is made to reciprocate by means of the lever, O, jointed to it. This lever, O, works on a centre at the lower part of the machine behind the scroll barrel, G, and it carries a pair of pulleys to embrace a raised zigzag scroll upon the barrel, G. By these means, the rotation of the barrel, G, causes the lever, O, to vibrate from side to side, and to communicate a reciprocating motion to the bar, N, and thread-guides, M. The reciprocating movements of the thread-guides are arranged to take place in such a manner that the thread will be crossed once during each revolution of the reel, B. This system of winding produces a skein of the description represented in fig. 3, in which the threads are disposed in the form of a figure 8, each individual thread crossing those above and below it at the centre. This kind of skein is much less liable to get entangled than skeins wound in the ordinary manner, as the several convolutions of the threads are kept quite distinct by the crossings. Various contrivances may be adopted for obtaining the reciprocating movement of the thread-guides required for producing the crossed skein, and the inventor shows one arrangement, in which the sliding bar to which the thread-guides are fixed, is worked by an eccentric driven by gearing connecting it with the winding reel.

Fig. 3.



HOLLYHOCK PAPER.

James Niven, *Keir, Dumblane.—Patent dated November* 10, 1854.

Mr. Niven here puts forth the claims of one of the many plants which grow luxuriantly, and with little cultivation, in all parts of the British islands, as a cheap raw material in substitution of the rags used in the manufacture of paper. The present invention, in fact, relates to the application or employment and use of the plant commonly known as the Hollyhock, or Rose-Mallow,—that is to say, the plant which, in the botanical classification of Linnæus, is the Althæa Rosea Monodelphia Polyandria, and is comprehended under the natural order "Malvaceæ," or of plants of the genera "Malva,"—in the manufacture or production of pulpy material from which paper is to be made, as well as in the manufacture or production of fibrous materials for textile purposes. The invention, as regards both these uses, applies to all the many varieties of the hollyhock plant, or the order "Malvaceæ," but more obviously and particularly to the ordinary large garden hollyhock. The stems of such plants furnish large quantities of long fibre of great tenacity, which fibre, when duly prepared, is most excellently suited for the preparation of a powerfully cohering paper pulp, as well as for use in textile manufactures. Being a perennial rooted plant, the roots are also largely available for the production of strong fibre. In adapting the stems of such plants to the manufacture or production of paper pulp, the plant is used either in a green or dried condition; it is preferred, however, to operate upon the stems immediately, or soon after the plants are cut or pulled in the ordinary manner of gathering and removing such plants. When the stems are removed from the earth, they are first of all steeped in water for a term of six or eight days, more or less, the practical duration of such steeping being regulated and governed by the actual resultant effect of the water; that is to say, the steeping is continued until the pure and valuable fibre will freely separate from the ligneous or woody portion of the stems.

At this stage of the process of manufacture, the stems under treatment are removed from the water or "steep," and they are then submitted to the action of any suitable mechanical arrangement for the purpose of beating or breaking them up. This breaking up may be effected in the general manner commonly pursued in the primary breaking of the flax plant, so as to disintegrate the fibres and break off the woody or ligneous portions of the stem. It is not, however, essentially necessary to remove the ligneous portions, as it has been found that the whole of the stem is fitted for being reduced to a pulp. During or subsequent to this disintegrating process, the mucilaginous or gummy matter, with whatever aqueous matter is present in the stems, is washed clear away, either by pure water, or by an acidulous solution, or by any other economical and effective cleansing agent. When the stems are thus fully reduced or disintegrated, the ligneous waste portions are removed, and the resultant fibrous mass is spread out in the open air, where the sun's rays can act upon it to bleach and dry. When so bleached and dried, the fibre may be stored away for subsequent use. In making paper from the fibre so prepared, the fibrous mass is bruised or broken down in any suitable mechanical apparatus, and it is then chopped or finely divided by any suitable cutting instrument. The reduced mass is then soaked in water, and worked up or macerated in the usual manner, as pursued in the ordinary manufacture of paper from rags, for the production of a pulpy mass suitable for the use of the papermaker. The pulp so made is capable of being used in the manufacture of paper, either alone or unmixed, or it may be commingled with other materials already in use in the paper manufacture. When the pulp is obtained, the subsequent routine of its manufacture into paper is similar to that pursued with the ordinary rag pulp, or it may be varied as the properties of the fibre may suggest.

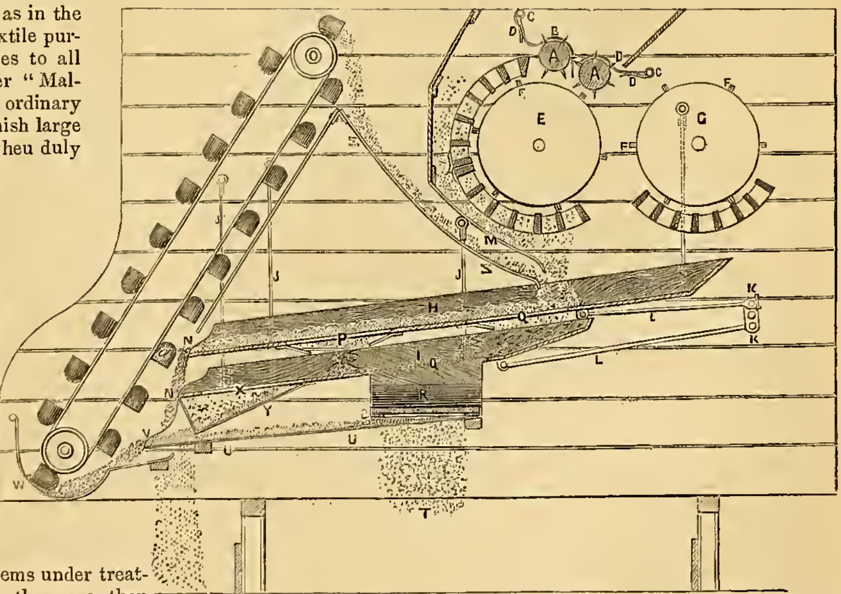
In the application of the hollyhock stems to the manufacture of textile materials, the fibres prepared in the manner just described are subsequently treated according to the existing textile processes; such processes, for instance, as are adopted in the flax manufacture. Being strong and of good staple, this fibre is particularly well suited for being prepared, spun, and woven into cloth. And it has been found, that the roots of the plants are also well adapted for the production of a remarkably strong fibre. Hence, in manufacturing practice, so often as the crop of plants grown for the purpose requires renewal, the roots are to be taken up and prepared for the obtainment of fibre, both for the manufacture of paper and for textile purposes. When taken from the ground, the roots are macerated and reduced, and the farinaceous matter contained in them being removed, the resultant fibre is employed in the manner already pointed out, but more particularly for the manufacture of paper.

THRASHING MACHINERY.

R. Maynard, *Whittlesford.—Patent dated October* 7, 1854.

This invention relates to various improvements in the details of thrashing machinery, and to an arrangement of dressing apparatus combined with the thrashing machine. Fig. 1 of our engravings is a longitudinal vertical section of the improved thrashing and dressing machine, and figs. 2 and 3 are transverse sections of one of the riddles composing the dressing details. Two spiked feed rollers, A, are employed, being made to revolve at different velocities. The spikes of these rollers work through slots formed for that purpose in two curved plates, B, which

Fig. 1.



work loosely on hinges at C, and are caused to approach each other at their edges, to within a limited distance, by springs, D, or other suitable contrivance. By means of this arrangement, if the rollers are irregularly supplied with corn, the action of the spikes upon the same will be properly divided or regulated by the giving or yielding of the plates, which, by their equal pressure upon the corn, will cause it to pass midway between the surfaces of the feed rollers. These feed rollers deliver the corn thrown upon them in the form of a continuous sheet to the beating drum, E, which may be either of the ordinary construction, or fitted, as shown in the figure, with short studs, F, placed immediately in front, or in advance of the ordinary beaters. These studs first strike the ears of corn and loosen the grain, and the beater immediately following them cleans it from the straw without injury. In portable machines, it is proposed to sometimes use a second drum, G, in conjunction with the drum, E, and the latter being set at such a distance from the concave grating, and driven at such a speed, as only partially to separate the corn from the straw, and the operation is completed by the second drum, G. For the purpose of separating the chaff from the corn and cavings, or short straws, two riddles, H and I, are employed. These riddles are suspended by the flat blade springs, J, or they may be hung by rods, or links, at any other convenient part of the riddles, and acted upon by springs; the object of introducing springs in connection with the riddles, being to prevent the shocks and unpleasant jarring and shaking during the vibration of the same. The riddles are actuated, or made to vibrate longitudinally, by the double cranks, K, and connecting rods, L, or by any other suitable mechanism. The thrashed corn having descended the incline, M, falls into the upper end of the upper riddle, H. In this riddle, the cavings are, in part, separated from the corn and chaff, and are delivered at the lower end at N, the delivery mouth of the riddle being divided, in order to deliver the cavings on each side of or clear from the spout, V, as shown in the figure. The greatest portion of the corn and chaff passes through the netted or perforated part, O, of the upper riddle, and the remainder, with a portion of the cavings, passes through the second perforated or netted portion, P. The former is riddled again at Q, in the second or lower riddle, I, and falls on to the sloping plates, R R, shown more clearly in the transverse section, fig. 3, from which plates it falls into the riddle, S. Through this riddle is forced a cross blast of air, indicated by the arrows in fig. 3, which air carries off the chaff, and delivers it at the side of the machine, the best corn falling down at T, whence it may be conducted by an elevator, or removed by any other means. The tail corn falls over the edge of the riddle, S, into a longitudinal trough, U, placed on one side of the riddle, and by this trough it is conducted to the spout, V, where it mingles with the second riddlings, and is with them delivered into the box, W. The cavings which pass the perforated or netted portion, Q, are carried along with those which fall from the netted portion, P, over the second netted portion, X, in the lower riddle, where they are perfectly separated from any corn that may remain in them, and are delivered laterally by a divided mouth, as described with reference to the upper riddle, at the end of the lower riddle, as shown in N. The corn being carried down the machines, Y (fig. 2), mingles with the tail corn, and with it is deposited in the box, W. It is then delivered on to the inclined plate by the elevator, *a*. On passing down the incline, Z, the corn mingles with the produce from the thrashing drum, and is subjected with it to a repetition of the riddling process.

Fig. 2.

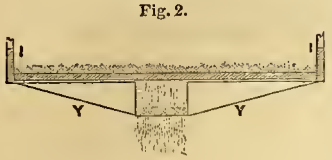
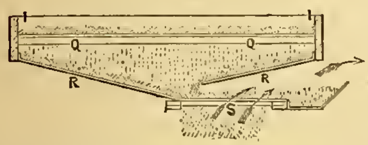


Fig. 3.

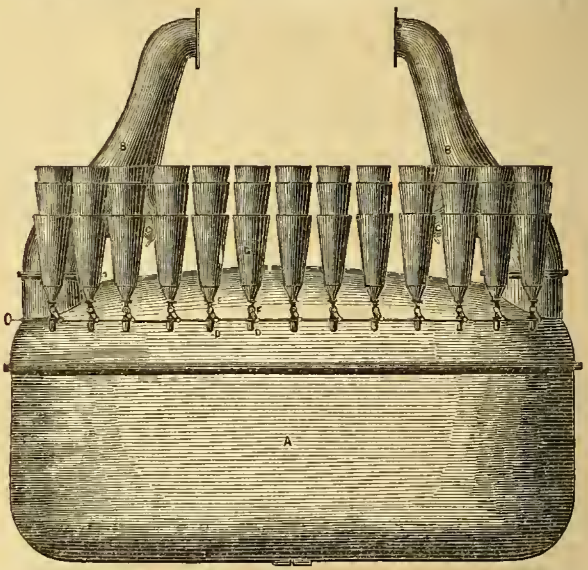


SUGAR REFINING.

JOHN WELSH, *Greenock.—Patent dated October* 24, 1854.

The object of Mr. Welsh's simple but efficacious apparatus is the more thorough and uniform extraction of the sirup, or treacle and moisture, from sugar, in the process of refining the same, and it consists in subjecting the loaves or cones of sugar which are to be drained, to the action of an air-pump or exhauster, thereby effecting the drainage of the sugar in a much superior and more complete manner, and in a much shorter time, and with less reduction in the weight of the sugar, than ordinarily arises in the processes hitherto in use. In carrying out the invention in practice, an air-tight chamber or vessel is employed, this vessel being put in communication with the suction pipe of the air-pump, and also with the bottom of the mould in which the sugar is put. The communication with the latter is preferred to be by a pipe provided with a stop-cock, to regulate the sucking or exhausting action. A mouth-piece may be fixed on the end of this pipe, such mouth-piece being composed of caoutchouc, gutta-percha, or some other suitable flexible material, so that, when the point of the mould is introduced, the atmospheric pressure will cause the mouth-piece to clasp it, and so form an air-tight or nearly air-tight joint. The communication of the air-tight receptacle with the air-pump is to be contrived so, that the sirup may not obtain access to the pump, and the receptacle is provided with a suitable outlet, with a stop-cock or valve, to discharge the sirup which is drawn from the sugar. Two or more pipes may be fitted to the air-tight receptacle, in order that two or more moulds may be operated upon at once, or so that the pump may be kept continually working, the moulds being changed in succession or otherwise.

Our engraving represents a side elevation of one modification of exhausting vessel, which may be employed in working out this invention. This exhauster is a closed vessel, A, of cast-iron, fitted with two pipes or funnels, B, which are made to communicate with the suction valve or valves of the air-pump or pumps. These air-pumps are not represented in the figure, but they may be constructed according to any of the systems at present in use, or—for example—they may be similar to those already employed in connection with vacuum sugar pans. The funnels, B, are provided with overflow escape ducts, C, to carry off the sirup, if by any chance it should be pumped up into the funnels, B. The cover of the vessel, A, is cast with a number of pipes, D, into each of which is screwed a separate mouth-piece, E. This mouth-piece is fitted with a stop-cock, F, and its open funnel-shaped mouth is furnished with a lining of caoutchouc or other suitable soft and elastic material capable of forming an air-tight joint with the apex, or lower pointed end of the conical sugar-mould, G. The sugar from which the sirup is to be drawn off being placed in the conical moulds, G, in the usual manner, these moulds are inserted in their several mouth-pieces, E, as represented in the drawings, and the stop-cocks, F, being opened to form a communication with the interior of the vessel, A, from which the air is being exhausted by the air-pumps, the consequent atmospheric pressure on the surface of the sugar at the upper open ends of the conical moulds, rapidly carries down the sirup into the vessel, A, leaving the sugar in the moulds in a fine dry crystallized condition. The stop-cocks are so arranged, that they may all be opened simultaneously by means of a rod. When the draining process is completed, the stop-cocks, F, are closed, and the moulds are removed, and are replaced by others containing fresh sugar, upon which the same treatment is repeated. The sirup is periodically taken from the exhaust vessel or receiver, A, as this vessel becomes filled, by means of a bottom discharge-pipe at H.



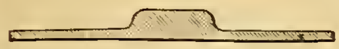
PERMANENT WAY.

T. W. KINDER, *Dublin.—Patent dated November*, 23, 1853.

Mr. Kinder proposes to substitute a hollow or bridge rail of a peculiar section for the ordinary solid rails, such hollow rail being of equal strength with, and of considerably less expense than the common rail. The rails are first rolled in long and nearly flat lengths, with a heavier amount of metal in the middle of the rail, and the plate is afterwards brought to its completed form by a second rolling process.

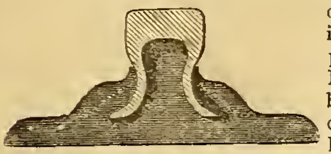
Fig. 1 of our engravings is a transverse section of a rail after undergoing the first rolling or shaping action, and fig. 2 is a transverse section of a completed rail as fitted in its chair. The central thicker portion of the plate, as represented in fig. 1, forms the top or bearing surface of the completed rail, and the thinner portions at the sides are bent down by the second rolling process to the shape represented in fig. 2.

Fig. 1.



Various sections of rails may be produced by employing suitable rolls in the second process. The rails may be secured in chairs of various kinds, and, amongst others, it is proposed to use chairs cast in position on the rail, according to Norris' patent. Or the rails may be made of such a section as to be capable of being fixed down to longitudinal sleepers by their side flanges. The patentee states that twenty per cent. in the weight of metal is saved, by making the rails of permanent way according to his improved system.

Fig. 2.



GAS PURIFIER.

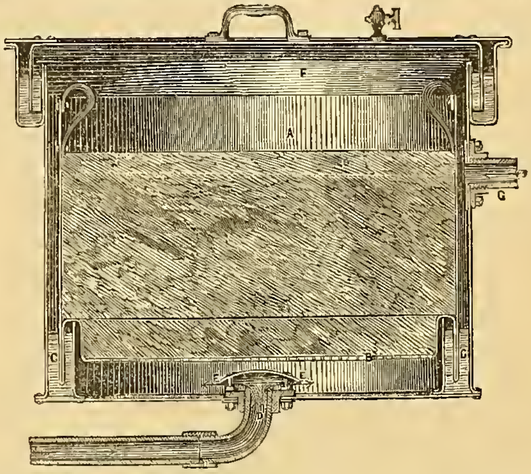
Rev. W. R. Bowditch.—*Patent dated January* 10, 1854.

This invention relates to a mode of purifying illuminating gas made from coal, or other materials, by means of clay or aluminous earth, applied either alone or along with lime. That clay which is of a red or yellow colour, is found to be best suited for the purposes of the invention, more especially after it has been subjected to the disintegrating action of rain, air, and natural changes of temperature. The clay or earthy mass is best prepared for purifying gas, by being dried in the open air, or by the agency of artificial heat, ranging not higher than about 212° Fahr. It is pulverized by heating or grinding, and then wetted or moistened with water until it attains the consistency of what is technically known in the gas manufacture as "dry lime," being capable of being formed into balls in the hand by gentle pressure.

When thus prepared, the purifying material is spread out to a depth of from two to six inches upon trays, riddles, or shelves, in scrubbing or purifying vessels, and the crude gas is then made to pass through these purifying layers, in the manner commonly adopted in the dry lime purification of coal gas. The purifying vessels containing the clay or aluminous earth are alternated with dry lime purifiers, the lime and clay being used in about equal proportions; but the gas under treatment ought to be passed through a clay purifier at the termination of the series. The number and size of these purifiers must depend upon the quantity of impurities in the gas. As a general guide, the quantity of lime should be the same as that now used in dry lime purification. Or, instead of using separate clay and lime vessels placed alternately, alternated layers, or strata of clay and lime, may be employed, being disposed in each purifying vessel; the final purifying layer being clay. It is also found to be highly beneficial to pass the gas through a "scrubber," placed between the condenser and the purifiers; this scrubber to contain clay spread upon riddles or trays, and either alone or mixed with breeze or other porous matters to facilitate the passage of the gas. The gas may also be passed through a vessel of a similar nature, placed in the line of the outlet main communicating between the gas-works and the consumers. This last cleanser is used for the removal of any impurity which may not have been removed by the purifiers, or which may have passed to the gas-holder with the unpurified gas at the change of the purifiers. The spent clay, after having purified the gas, is removed from the purifiers, and is spread out and exposed to the action of the air, when part of the absorbed impurities are volatilized, and the clay being thus partially cleansed, may then be used over again; and it is generally found that the clay will act efficiently for three times.

This process refers especially to the employment of the clay and aluminous matter in the same way as "dry lime." If the "wet lime" system of purification is to be applied to this clay process, then the purifying matter is to be mixed with water until the mass attains the consistency of what is known in the gas manufacture as "wet lime." Such moistened matter is applied in the purifying process, in exactly the same manner as wet lime, and alternately with it—the quantities of wet lime being the same as those usually employed.

And, in addition to the above processes, or to the ordinary purifying process, it is also proposed to apply this invention of the purifying of gas upon the premises of the consumer in a vessel called a "domestic purifier." The annexed figure represents such a domestic purifier in vertical section. This domestic purifier may be made of iron, or of other suitable material; and when clay only is employed, it may be of the form shown in the figure, in which A is the body of the internal box, with a perforated or permeable diaphragm, B, at the bottom, to hold the purifying agent, with which A is to be filled. This vessel has its lower end prolonged, as at C, to form a fluid joint. The gas enters from the main by the pipe, D, passing beneath the cover plate, E, and thence issuing through the purifying layer, B. Above this layer, the enclosed space forms a reservoir for the purified gas which escapes by the side pipe, G. As here arranged, the gas from the main is assumed to have been purified at the works by the alternated clay and lime layers, and it now passes through a clay layer only on its way to the place of consumption. Where the gas at the works is not purified by passing through alternations of lime and clay, it is desirable to alternate them on the premises of the consumer, in which case the domestic purifier must be fitted with the necessary shelves or trays. This domestic purifier is to be erected on the premises of the consumer; so that, by passing it through his own purifying strata prior to burning it, he may conveniently remove all impurities which may remain in the gas as it comes from the works, or which it has absorbed from the foul mains or meters through which it has passed. The spent clay as discharged from the purifiers, and saturated with impurities, makes a useful manure, and this material is accordingly employed for this purpose; first allowing it to dry, then pulverizing it, and afterwards spreading it on the ground. When the material has been well saturated, it has been found that five or six cwt. per acre is a good quantity; a somewhat greater quantity will be required if the material is not fully saturated.



REVIEWS OF NEW BOOKS.

More Worlds than One, the Creed of the Philosopher and the Hope of the Christian. By Sir David Brewster. London: Murray. 1854.

This is a book in the spirit of the old philosophers, who loved to believe things which they were unable to prove. It is not a book that one likes to see emanating from a man who has justly won fame and honours by his successful researches in physical science in modern times. As a thing to dream about in vacant hours, we have no objection to the supposition, that the planets, as well as more distant orbs, are inhabited by beings possessing intellectual faculties; but, as a dogma to be thrust down our throats by the pole of argument, we must decidedly repudiate it. In point of fact, we are in entire ignorance as to the contents of every star but our own, and all that can be said on the subject one way or other might be printed on a single page. Sir D. Brewster has expanded what was intended originally as a review article into a book of 262 pages. In a contribution to a periodical, a certain amount of fine writing and cutting remark (and Sir David loves to indulge in both) may not be out of place, but in a sober, scientific volume we think they are.

"Universal life upon universal matter, is an idea to which the mind instinctively clings." That may be, but it did not require a book to tell us that, nor does an instinctive belief prove the truth of the thing believed. It was at one time universally believed that the sun moved round the earth. The fact of the sun's motion was not, however, thereby proved. If, however, we at once assume the existence of reasonable creatures upon the planets, our imaginations may run riot in picturing the modes of that existence, so as to make it square with such facts as we are acquainted with regarding those planets. Thus, the difficulty of the smallness of the light transmitted by the sun to a distant planet, like Uranus or Neptune, may be got over by supposing their inhabitants to have eyes with larger pupils. If we place inhabitants upon Mercury, we have only to suppose that his atmosphere has the property of absorbing the greater part of the rays of heat as they are showered downwards by the sun, and the inhabitants need be subjected to no more heat than we of the earth. But how could the sun's inhabitants endure the intense heat which must necessarily be supposed as residing in that body? Why, we can imagine that beneath the luminous and calorific envelope of cloud from which our light and heat are derived, there is another stratum of cloud protecting the body of the sun from the extreme heat and brightness of the exterior stratum. But, according to the author, we are not called upon to believe that there are inhabitants upon either sun or satellites, since these bodies have certain peculiar functions in the system. It is, then, according to him, only when we can find no other use for a heavenly body that we need place inhabitants upon it—a doctrine which comes to this, our belief ought to bear a direct proportion to our ignorance. This doctrine, when thus nakedly stated, few persons will be found bold enough to maintain, in the realm of science at least; but it comes up but too frequently, cloaked in various disguises, and it ought to be exposed whenever detected, for it is a most serious obstacle to the advance of truth and knowledge.

We must likewise protest against the arrogant and acrimonious language which the author makes use of towards the essayist whose positions he has undertaken to controvert. Those positions may be indefensible (we give no opinion upon the point, one way or other), but it is not justifiable in Sir David to attack them in the manner he has adopted. On one page we find a charge of high presumption preferred; on another the essayist is said to use neither the language nor the tone of a man of science in search of truth, or holding in respect the great revelations of astronomy. Here, Sir David's opponent is told that his theory bears upon its front the stamp of folly and irreverence; on a previous page he is informed that his sentiments and conjectures are insulting to astronomy, and cast such ridicule even on the subject of his own work, that they are only to be ascribed to some morbid condition of the mental powers, which feeds upon paradox, and delights in doing violence to sentiments deeply cherished, and to opinions universally believed. We think our readers will admit that such language as this, used towards a man who has a high scientific reputation, transgresses the bounds of fair discussion. Again, a certain speculation is characterised as bordering on the blasphemous (this to a Doctor of Divinity, as the author of the essay, "Of a Plurality of Worlds," is understood to be); other speculations are styled dangerous, &c. &c. This is the old, and, we hope, soon to be antiquated spirit which denounces all speculations not corresponding with our own notions, or the notions of those who have gone before us, simply because they do not so correspond. It was in this spirit that Galileo's hypothesis as to the earth's motion was condemned as dangerous; and it was in this spirit that some modern speculations of geologists, now generally admitted to be founded on truth, were similarly characterised. It does not fall within our province, whilst writing in these pages, to discuss the boundary between religion and science; but it is now becoming pretty generally understood, that, to draw a threat from one for the purpose of inducing an inquirer to swerve from his path in the other, will do no good to either.

We would respectfully recommend the author, when printing another edition of his book, to look to his Latin; and if, after proving his opponent's argument to be absurd, he should still desire to show that it is even more absurd than his, he should put his own argument into the form of a *reductio ad absurdius.* The expression made use of (*argumentum ad absurdiorem*) has no meaning.

The Screw Propeller: A Letter with Documents relating to the Invention of the Screw Propeller used in the Royal Navy. By Captain E. J. Carpenter, R.N. London: Seeley. 8vo. Pp. 69. 1855.

This pamphlet was prepared to support a motion recently made in the House of Commons on behalf of Captain Carpenter, to inquire into the distribution of £20,000, voted by the Commons for payment of the patentees, who had claims on the Government in reference to the screw propeller. As this motion has already been discussed in Parliament, and the matter decided unfortunately for Captain Carpenter, we need say very little upon the subject. The gallant captain endeavoured to make out a very plausible case, to the effect that the Commons had voted a sum of money to recompense such inventors as had been instrumental in bringing the screw propeller into use, and that he was one of the inventors concerned, and was, therefore, entitled to a share of the recompense, which he had been unable to obtain, and for which he sought for compensation. The £20,000, however, was paid to those patentees whose patents validly covered anything in the screw propellers used in the navy; it was paid to them as royalty, to free the Government from claims in connection with the screw propeller, just as any private individual might pay royalty to a patentee for the use of an invention. Great credit is undoubtedly due to Captain Carpenter for what he did in connection with the screw propeller—and he deserves to have succeeded better in a pecuniary point of view—but the grant in question was not at all applicable to his case, for the reason that he held no valid or established patent right over the propeller used in the navy. At least in the eyes of the Government he has no valid patent right, Sir F. Thesiger, in his place in the House, having declared the patent to be worthless, with which opinion we fear we must agree. It is still open to Captain Carpenter to establish his patent right by legal process, if such be possible, and should he be able to do this, he will then have a claim upon the Government, as upon all other users of the propeller in question.

Logic, or the Science of Inference: A Systematic View of the Principles of Evidence, and the Methods of Inference in the Various Departments of Human Knowledge. By Joseph Devey. Bohn. 1854.

It was a mistake of the publisher to issue such a work as this in his philological library, or, indeed, in any of his libraries. It is the most illogical work on logic that ever fell into our hands, and it is an act of kindness to those who wish to study the subject, to warn them against Mr. Devey's treatise, which will confuse and disgust, instead of inviting and instructing. His language is vague and obscure in the extreme; but what could be expected from a writer who evidently does not understand the subject which he undertakes to instruct others upon? Our readers may ask how a man can compose a book upon a subject which he does not comprehend. We will tell them: the would-be author collects all the books upon that subject which he can find, and taking a bit out of one, and a bit out of another, with a sentence or two of his own, by way of cement, he can soon put together something that (to use Charles Lamb's phrase) looks like a book, but is not a book.

Every page of this treatise supplies proofs of our assertions; but unintelligibility is a difficult thing to grapple with, for how can you argue with a man when you do not understand his language? It is evident, however, that the utility of a book upon this subject, as upon most subjects, depends upon its capability of being understood. However shallow a writer on logic may be, he must, at all events, be comprehensible. But in this treatise there is hardly a single sentence, at the end of which, read it as often as you will, you are not left wondering what it is the writer means. Frequently the grammar is at fault. For example—"there *are* a class of notions" (p. 39); "each of these two classes of ideas *are* inverted," &c. (p. 55); "discoveries of modern chemistry *tends*," &c. (p. 207); "our notion concerning its leading properties *are* incomplete" (p. 55); but neither bad grammar, nor the ill construction of sentences, will conceal all the mistakes, in matters of fact, with which the book swarms. At page 38, the writer speaks of "the notion animal connoting qualities"—a *notion* connoting! At page 41, he tells us that redness is a *property* of blood; using property in a technical sense, as a translation of the schoolmen's *proprium.* If he had remembered that there are white-blooded as well as red-blooded animals, we suppose he would not have made the assertion. But, assuming that we had no instance of animals with white blood, still, even in that case, redness would not be a *proprium,* but only an *inseparable accident* of blood. On page 43, he talks of confounding the operation of narrowing a term with the statement of, &c.—confounding an operation with a statement! confounding an act with a word! As an instance of the way he borrows without acknowledgment, we may refer to page 35, half of which is transcribed from Mr. John Mill's work on logic, with the alteration of a word here and there; and we may add, that Mr. Mill's work has supplied Mr. Devey with half his illustrations and examples. In Book V. of the treatise under review, page after page has been decanted out of the same valuable work, and damaged in the process. And yet we find this man of blunders repeatedly sitting in judgment upon, and censuring the writings of such men as Archbishop Whately, Sir William Hamilton, and

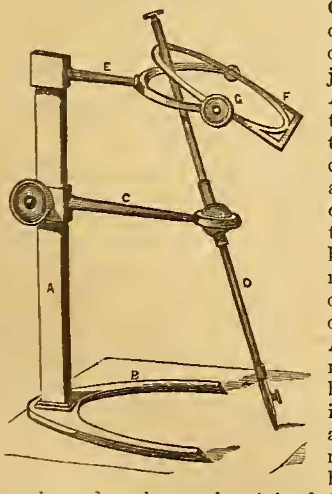
Mr. John Mill, with as much solemnity as if he understood them! Dr. Whately is charged with confounding things with each other; Sir William with laying down a principle, the practical exemplification of which would be a mark of insanity; and Mr. Mill with playing in argument with the double sense of a word, in a manner unworthy of his attainments. We call that modest in a man of Mr. Devey's mental calibre and acquirements. Again, Dugald Stewart was of opinion that the study of logic ought to follow that of the sciences, and Dr. Whewell seems to be of the same opinion. Mr. Devey tells us that he deems this opinion a very erroneous one. Mr. Mill is accused of attempting to confound necessary truths with those of a physical nature! and in another passage, a certain supposition of the same writer is said to be ludicrous, and to require a quixotic imagination! For what end or purpose the supposition in question requires such an imagination, we do not know.

We shall conclude our notice of this book by citing one or two passages as samples of the writer's opinions, or of his perspicuous mode of expression. "Logical analysis is a *reductio ad absurdum*" (p. 144); "a class of objects which surpasses our comprehension, because the truths it embraces belongs to a class of subjects which we are unfitted to realize" (p. 161); "an indiscriminate number of cases" (p. 160), meaning an indefinite number. "The very idea of a body existing in a certain mode, postulates the existence of four things: viz., existence; existence of a thing distinct from me; the existence in me of certain sensations produced by a thing distinct from me; and that this thing is the cause, and is able to be the cause of these sensations." Even a schoolboy cannot fail to see that the fourth falls under the third "thing," and no schoolboy writing his weekly theme would have spoken of the *existence* of *existence*, as a thing postulated, as Mr. Devey does.

CORRESPONDENCE.

VARIABLE ELLIPTOGRAPH.

The annexed sketch is a perspective view of an elliptograph, which I have recently contrived and patented. The instrument consists of a column, A, supported by two spread-out feet, B, the points of which serve for setting the instrument by; and there is also a point at the foot of the column for the same purpose. On the column is fitted, by means of a socket, an arm, C, into the end of which is fitted a ball-and-socket joint for the pen or pencil-holder, D. A second arm, E, is fixed at the top of the column, A; and the outer end of this arm is forked, and supports a circular ring, F, which can be set at any inclination by means of a screw, G. The pencil-holder, D, passes through the guide ring, F; and being kept in contact with it whilst being rotated, is made to describe an ellipse on the surface beneath, in consequence of the obliquity of the guide ring. An index may be jointed to the arm, E, so that the guide ring may thereby be set to any required angle, the index being turned out of the way after the ring is set. The arm, C, is made to shift up and down the column by means of a pinion working in a rack on the column, the pinion being turned by means of an external button. By shifting the arm, C, the size of the ellipse may be varied at pleasure; whilst the relative proportions of its axes depending on the inclination of the guide ring, F, may be varied by setting this ring accordingly. I am convinced this instrument will be found generally useful in isometrical drawings, and also in mechanical drawings of various kinds.



Gloucester, May, 1855. P. B. Eassie.

[This is a very neat arrangement of elliptograph, but we fear that there will be great difficulty in setting it so as to draw any desired ellipse; for a little consideration will show that the centre of the delineated ellipse will not coincide with the point of intersection, with the surface on which the ellipse is drawn, of the vertical line passing through the ball-and-socket joint, and through the centre of the guide ring above.—Ed. P. M. J.]

WINDOW VENTILATION.

Annexed are two designs for ventilating contrivances, to be applied to windows. In the design represented in transverse vertical section in fig. 1, a passage is formed on the sash frame of the window, by means of two brass or zinc plates, A; and this passage is provided with a regulating valve, B, adjustable by means of a cord at the side of the window. In the passage, there is also a light valve, C, to exclude back draught. The form and stiffness of the plates forming the air passage may be preserved, by placing wooden stays between them at intervals.

Fig. 1

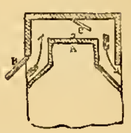
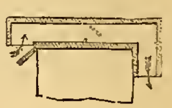


Fig. 2.



In the design represented in transverse vertical section in fig. 2, the passage is made in a similar manner, but is situated in the window frame itself, instead of in the sash frame; and this will probably be the preferable arrangement.

March, 1855. S.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SCOTTISH SOCIETY OF ARTS.

April 9, 1855.

"On a Self-acting Feed and Brine-discharging Apparatus for Marine Boilers," by Mr. James Spence, Portsmouth. Sea water contains salt in the proportion of 1 to 32; to get rid of this salt, which crystallizes very rapidly in the marine boiler, many plans have been adopted. It was an early and long-standing practice to blow off large indefinite quantities every four hours. It was then found more economical to pump out by pumps, worked by the steam engine, a given proportion of surcharged or brine water. This self-acting feed and brine apparatus is designed to discharge the brine by means of the pressure in the boiler, a proportionate quantity, say 2·7 brine, 9·6 feed. The brine valve is in connection with the feed valve; the latter is acted on by the engine, and is opened or shut more or less in proportion as the engines are going slow or fast, or suddenly stopped. The principle on which it is designed is, that the out-going brine is always in proportion to the in-coming feed, however much that may vary.

"On the Condensers used in the Royal Navy for Distilling Fresh Water," by the same author. A French steam-cooking galley, constructed so that the fuel expended in cooking should also be used in distilling fresh water, was, a few years ago, so altered and improved by Mr. Grant of the Royal Clarence Victualling Yard, that Grant's galleys were coming into general use in the royal navy. It was afterwards proposed to fix a condenser on board all steam screw-ships, and to connect these condensers with the boilers of the steam engines. The condensers are placed under the water line of the ship, when the sea water is, by a simple arrangement of pipes, allowed to flow round the outsides of a series of small tubes through which the steam is passed, condensed, and run into the tank-hold of the ship, without any manual labour being required in the operation. The proportions of condensing surface in the tubes are, for every 100 men, where one condenser only is used, twenty square feet; where two are used, sixteen square feet. The quantity made per hour about 150 gallons, or three tons.

The instrument called the Gyroscope was exhibited in action, and described by James Elliot, Esq. After alluding to the general interest excited in the theory of rotatory motion, within the last three or four years, by the famous pendulum experiment of M. Foucault, and by the supposed connection of the same theory with certain irregularities in the motion of rifle balls, Mr. Elliot briefly described the various instruments employed for the illustration of the subject by Bohnenberger, Tessel, Magnus, and Foucault, and showed the greater part of the experiments performed by these parties, at the same time explaining the principle of the composition of rotatory motions, and the different results of that principle under different circumstances. The very beautiful experiment of M. Foucault was described, in which a rotatory disc or siphon, nicely balanced, adjusts itself so as to place its own axis parallel to that of the earth itself, and to bring the direction of its rotation into coincidence with that of the earth; but this result was not attempted to be exhibited, in consequence of the gyroscope employed not being constructed with sufficient delicacy. A similar result, however, was shown, by giving to the disc, when in rotation, a simultaneous revolution round an external centre, when the axis and direction of rotation immediately came into parallelism and coincidence with those of revolution, the one or the other pole rising according as the direction of revolution was from east to west, or from west to east. The last-mentioned result, Mr. Elliot thought, might possibly be employed to throw some light on the hitherto unexplained facts of the coincidence of the direction of rotation of each planet with that of its revolution—of the coincidence in the direction of revolution of most of the satellites round their primaries, with that of the primaries themselves round the solar centre; and, finally, of the general agreement, in the direction of revolution, of all the planets round the sun, that direction probably harmonizing with a revolution of the whole solar system round a remote sidereal centre. An original experiment was shown in illustration of the same theory. A sphere, made hollow from beneath to above its centre, and with a steel axis, was made to rotate with the point of the axis coinciding with the centre of gravity. A magnet was then brought near the upper external part of the axis; but instead of drawing the axis towards it, it produced an incipient rotation at right angles to the direction of the attracting force. It was also stated that, in a previous experiment, a cylindrical magnet, placed vertically, was found to produce a rotation of the steel axis round the magnet in an opposite direction to that of the rotation of the ball, and, consequently, changing with it. The resemblance of the result to the effect produced by a magnet upon a wire conveying an electric current was pointed out, with a hint as to a possible similarity in their causes. The causes of the deflection of a rifle-ball to the right hand, and of the boomerang to the left, as assigned by Magnus and others, were fully explained, but not regarded as altogether satisfactory. For the illustration of the former, the gyroscope, in rotation, was suspended by a string, and when made to swing in the direction of its axis, it was found that, invariably, with a left to right rotation, the axis turned towards the right, and with a right to left rotation, the axis turned towards the left. Since rifles are all made with left to right screws, the ball requires a rotation in that direction, and consequently, as Professor Magnus considers, a deflection to the right. That, however, will depend upon the question, whether the resistance of the air has the same tendency as the suspending chord—viz., to raise the advancing extremity of the axis of rotation, and that, again, probably depends on the form of the ball.—Thanks were voted to Mr. James Bryson for contributing the gyroscope, and to Mr. Elliot for his description of it, and his interesting experiments.

April 23.

Messrs. Schenck and Macfarlane, of Edinburgh, exhibited various specimens of improved lithographic work, as well as new applications of the art.

"On an improved Double-action Force-pump," by Robert Aytoun, Esq. A working model was exhibited. The inventor's attention was drawn to this subject in consequence of the bad performance of the common double-action force-pump, which was generally found to be inoperative in the up-stroke, from the presence of air. He stated that he had succeeded in the present machine in rendering the presence of air harmless, and in making both down and up strokes completely effective, at the same time that the machine itself is more simple and less cumbersome. It consists of an ordinary plunger working through a stuffing-box fixed upon the end of a working barrel. The area of the cross section of the working barrel is double that of the plunger. Attached to the lower end of this plunger, and working in the barrel, is an ordinary lifting bucket with valves. Below the working barrel is a stationary valve, and below this again is the suction pipe. Near the top of the working barrel, a bent pipe leads to the bottom of the stand of pumps. The action of the pump is as follows:—The plunger being forced through the stuffing-box into the barrel, displaces its own bulk of water, and sends it through the bent tube into the stand of pipes; while the lifting bucket, descending with open valves, allows the whole contents of the working barrel to pass through and to get upon its upper side. On the return stroke the whole water in the working barrel is raised by the lifting bucket. One-half of this water serves to fill up the void caused by the simultaneous withdrawal of the plunger, and the other half escapes, as before, through the bent tube into the stand of pipes. Thus, a quantity of water is raised, at each half stroke of the engine, exactly equal in bulk to the plunger. As the upper part of the working barrel, where the stuffing-box is situated, has at all times a free communication with the water in the stand of pipes, without the intervention of any valve, it is plain that no air can leak through the stuffing-box into the working barrel; and if any air enter through the suction-pipe, or wind-bore, it will at once rise to the top of the working barrel, where it will assist by its elasticity in maintaining a continuous flow of water, until it find its way through the stuffing-box into the atmosphere.

In the discussion which ensued, Mr. Landale said that the pump was admirably suited for many purposes, particularly where it could be got at readily, for renewal of cluck and bucket, such as shafts of moderate depth, where the water would not flow over the working parts, and where the pump-rods were neither long nor heavy—where they were so, the single plunger was preferable, because the column of water to be lifted balanced the rods. In many situations where the engine was near the pump, and in inclined mines under ground, it was an excellent contrivance, and simple in its parts, and a vast improvement over the old four valve double-action solid plunger pump, which was a troublesome customer, and very often lost the water on one side, and was being very generally abandoned about collieries. Mr. Landale said, however, that although he knew his friend Mr. Aytoun had really invented it, yet it was not new, as he had had it from Mr. Neilson of Hyde Park, Glasgow, some four years before. Mr. Landale also pointed out one similar in principle, in the last month's *Practical Mechanic's Journal;* but it having two sets of rods, two barrels, and too small an area of suction-cluck, it could not be compared at all with the simplicity of Mr. Aytoun's pump. But neither were new; both he and his brother had been familiar with them for years; but Mr. Aytoun had not the less merit, or the less pleasure in inventing it over again.

"Should Lightning Conductors for the Protection of Buildings Terminate at their Upper Extremity in a Point or a Ball?" by J. Stewart Hepburn, Esq.

A discussion followed, in which Messrs. Elliot, Sang, Adie, and Professor Macdonald, took part. Mr. Elliot maintained that the advantage of pointed terminations to lightning conductors is so well known, being universally practised and equally universally acknowledged by men of science, that there is no room for doubt on the subject. That—in reply to Mr. Hepburn's question, whether a point would present sufficient surface to transmit a large quantity of electricity?—he (Mr. Elliot) had ascertained, by experiment on electricity of low intensity, that although a fine wire, of considerable length, offered an impediment to the transmission of a large quantity, yet that a point, however fine, caused imperceptible diminution of the current passing through it, if the point was not too much elongated, but quickly widened into a conductor of sufficient thickness; that the alleged failures of lightning-rods never occurred when the communication with the ground was perfect, and when not too distant from exposed parts of the building; but that, to insure the former point, the lower extremity of the rod must be led into a body of wet soil, or connected with the gas or water-pipes.

Mr. Sang maintained that lightning-rods had not the effect of attracting the lightning, but were useful in so far as that, when the lightning struck a building, the rod, being the best conductor, gave a free passage to the lightning towards the earth; and hence, that it signified little what was the shape of the apex of the rod, as it would be better still if we could encase the whole building in a metallic coat. Mr. Sang further maintained, that experimenting in a laboratory was a very different thing from a thunder-storm, ranging, perhaps, sixty miles among the clouds, as he had frequently seen it; and that, in point of fact, we knew little or nothing on the subject.

Mr. Adie stated that, practically, in fitting up lightning-rods, he did not trust entirely to the apex of the rod, but connected by metallic straps all the metal work of the building, such as the lightning-rod itself, and the head of the roof, and water-pipes, &c., so as to give free passage to the lightning to the earth, whatever part of the building should be struck.

In answer to Mr. Sang's remark, that the quantity of electricity in a thunder-clould was so great that it could not be compared with ordinary experiments, Mr. Elliot said, that a battery was in all cases discharged by a point at a much greater distance than by a ball, the size of the battery making no difference whatever; that some batteries have been constructed so large, as to make a near approach to containing a flash of lightning; and that Professor Faraday had established the fact, that the quantity of electricity in a thunder-cloud was not great. In reply to another objection of Mr. Sang's or Mr. Adie's, that it was not likely that a flash of lightning dashing from a cloud would light just on the point placed to receive it, Mr. Elliot maintained that Faraday's experiments led to the belief, that a flash of lightning does not issue from the thunder-cloud at random, but has its whole course marked out for it before its motion commences, which course is simply the line of least resistance, or of greatest tension, whether straight or curved.

Mr. Hepburn, in a letter to the Secretary, stated that, in the view of erecting a lightning-conductor, he was led, on consideration, to doubt the efficiency of the conductors usually adopted, terminating in points, being contrary to the plan found to be necessary in the management of artificial electricity, in which, while the fluid is gradually collected from the excited cylinder by a row of pointed wires attached to the prime conductor, its transmission from the conductor to the battery, and the discharge of the battery itself, is always effected by balls. It thus appears that, for the absorption and transmission of an accumulated mass of electricity, an extended surface is required; and as, in the protection of buildings, it is necessary to provide for the instantaneous absorption of a concentrated mass of electricity, darting through the air in the form of a flash or ball, Mr. Hepburn conceived that the conductor ought to terminate in one or more pear-shaped balls, having a surface sufficient to absorb at least as much of the fluid as the descending rod is capable of conveying to the earth. It remains to be determined, whether a large hollow ball or smaller solid one is preferable.

"On a Reversing Turbine," by Mr. G. Weir, of Glasgow. A working model was exhibited. This invention was stated to consist of an improvement on the common turbine, which only runs the one way; consequently, when an opposite direction is required, it can only be obtained by the intervention of a clutch and reversing wheels, which method is attended with the danger of breaking down all the gearing connected therewith. Whereas the reversing turbine, being supplied with two sets of arms, and a valve so adjusted that it throws the water either into the right-about or left-about arms, or stops it altogether. These evolutions can be easily performed, merely by shifting the lever connected with the valve.

"On a Plan of Stereotype Moulding for Casting Brass Nails at Portsmouth Dock-yard," by Mr. J. Spence. A model was exhibited. This is a contrivance by which the old system of moulding, even the smallest article—by taking out of the sand and manipulating every separate pattern, and where skilled labour is used—is superseded. By this plan of a fixed pattern on a plate, carefully fitted up, any number of castings can be produced from the same pattern, by which plan skilled labour is entirely superseded, the production of small articles, especially, indefinitely increased, and the quality of the articles produced materially improved.

"Suggestions:—1st, For an Improved Construction of Ball-proof Floating Batteries; and, 2d, For Steam Tenders, or Generators, for the Royal Navy and Mercantile Marine." By John Steane, Esq., Commander, R.N., Transport Service, Balaklava. Communicated by James MacGillvary, Esq., Ordnance Commissary, Balaklava, Crimea.

SOCIETY OF ARTS

April 25, 1855.

"On Public Works for India, especially with Reference to Irrigation and Communication," by Colonel Cotton.

The author commenced by remarking, that besides innumerable minor works, which were required in every country fully to develop the material, and even moral welfare of a people, there were, first, in a tropical climate, or even in an extra-tropical one, which had a rainy season, that was sometimes very scanty, works of irrigation; secondly, in all climates, communications; thirdly, harbours. In India, water is raised from wells and rivers in every district, from the Himalayas to Cape Comorin, by means of bullocks and men, for the purpose of irrigation, at an average of about 6000 cubic yards for a pound sterling, and by means of works on a large scale, from 100,000 to 300,000 cubic yards, are applied to the land for a pound sterling. The works for the irrigation of the delta of the Godavery, 400 miles north of Madras, were then described, from which it appeared that their cost will be about £300,000, and that the water will be distributed over 1,200,000 acres, at a cost of about a pound sterling for every 30,000 cubic yards. This included the making the channels navigable, and all the larger ones fit for steam-boats. Another proof of the value of irrigation works might be given. In the Madras presidency, during the last thirteen years, these works had increased the government revenue 70 per cent. on the outlay: and, including the profit to the landowners, it could not be less than 200 per cent. With respect to the movement of goods, the fundamental principle seemed to be, that "everything was worth more in some other place than where it was;" and, consequently, that an increased value could be given to it by moving it, if it could be transported sufficiently cheap. Hence the object to be arrived at was the "annihilation of the cost of carriage." In a vast continent like India, internal communications were of infinitely more importance than in a small country like England, with its natural, cheap water communication round its coast, always within a few miles, comparatively, of every part of the country. Now, what was the true state of the case? Why, in each district there were, perhaps, fifty miles of imperfectly made road, on a surface of 10,000 square miles, equal to ten English counties; and possibly not a single mile, excepting the carriage drive, at the principal European station. There were, certainly, a few miles of made road, provided with bridges in some districts, and there was one extended line up the valley of the Ganges. But these did not fairly represent the state of the country; they were very rare exceptions. In the Agra presidency, in the Punjaub, and in Mysore, a good many miles of road, more or less complete, had been made; but he believed that only one district in all India had been regularly provided with practicable roads, steadily carried on year by year, for the last thirty years, so that it had now 1000 miles on a surface of about 5000 square miles. There were also about 150 miles of railway now open, and they were proceeding at the rate of about 100 miles per annum. But if they proceeded at ten times this rate, it would take 130 years to open the country even to the extent England was provided with communications of this kind; and even then, several hundred thousand miles of common roads, or light railways, or canals, would be required. In the author's opinion, railways did not, and could not, answer as main lines of communication for goods, as they failed in two essential points—the power of conveying a quantity of goods at a low price. Indeed, in a poor country like India, cheapness was the grand desideratum both for passengers and goods, and high speed was comparatively quite insignificant. Perhaps the most remarkable exception to the state of India generally, with respect to communication, was the district of Rajahmundry. The new works there had already provided about 600 miles of connected water communication; and when the works were completed, there would be full 1000 miles, equal to about one mile for every three square miles of surface. In a few years, when the whole delta is opened, there could be no doubt but that more than 100,000 tons would pass along it; and when the Upper Godavery came to be navigated, this would probably be increased to 500,000 tons. In Colonel Cotton's opinion, whatever the feeders might be, the main communications in India must ultimately be canals or rivers. For the feeders, nothing could be done so quickly as to lay down light railways, to be worked at a low speed. A line of this description had recently been ordered to be laid down from Negapatam, 180 miles south of Madras, to Trichinopoly, due west 90 miles. One had also been ordered in Bengal. The state of the coast in respect of harbours was just the same as the interior in respect of communication and irrigation. Madras was at this moment in precisely the state it was when we first occupied it. There was neither a breakwater for the shipping, nor any means of communicating from it to the shore, except by the catamarans and masoolah, or surf boats, that we found there. Not £20,000 had been spent in all the ports in the Madras presidency. At Coringa, on the east coast, there was a safe anchorage; but for want of a dredged channel, of three or four feet deep, through a bank, ships could not get into the river for repairs if they drew more than nine feet. India presented an unbounded field for the employment of English capital, and in proportion as the natives became sellers of all those raw materials which are required for our manufactures, would they in return necessarily become purchasers from us.

May 2.

"On Juvenile Crime, as it affects Commerce, and the best Means of Suppressing it," by Mr. J. Simons.

INSTITUTION OF CIVIL ENGINEERS.

May 1 and 8, 1855.

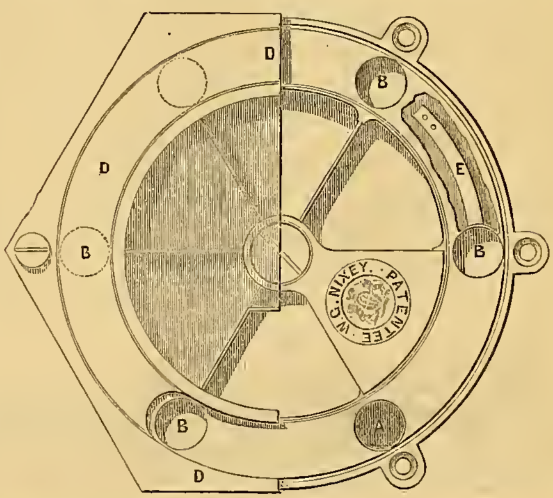
Discussion on Mr. Barton's paper.

MONTHLY NOTES.

The Liverpool Floating Landing Stage in the Mersey.—Messrs. T. Vernon and Son, the iron ship builders, have for some time been engaged in this great work, intended for use opposite Prince's Pier. The preliminary operations are all being conducted on the Cheshire side of the river, where extensive wooden sheds, 240 feet in length by 100 feet in width, store-rooms, offices, and other conveniences have been erected. In the centre of the sheds rises a tower 50 feet in height, which has rather an imposing appearance at a distance; and under this has been placed a large riveting machine, besides a travelling machine of huge dimensions. The pontoons will be manufactured under the sheds, and will be removed to their several positions by means of tram-roads which will be laid down. A steam engine has been at work for about a fortnight preparing the necessary tools and implements required for the work; and at present a number of joiners are employed in finishing the sheds, store-rooms, and offices. The land devoted to the laying down of the new landing stage requires yet to be levelled, and probably five or six weeks will elapse before the whole of the preparations are completed for proceeding in earnest with the building of this monster vessel, which will materially facilitate the immense and rapidly-increasing passenger traffic on the Mersey. The stage is to be 1,000 feet in length and 82 feet wide, a space of 40 feet at each end being reserved for small steamers. The main support of this immense structure will be pontoons, of which there are 67 of various lengths, formed on a similar plan to those employed in the landing stage at George's Pier. The stage is to have a uniform draft of three feet of water, and with the erections and stores on deck there will be a weight represented of 4,500 tons. The mode of securing the stage is to be on a similar plan to that adopted at the present large stage, by a set of horizontal moorings, fixed in a diagonal direction, under-foot moorings being introduced for greater security, and to prevent any liability to accident. Four strong bridges will connect the stage to the Prince's Pier, attached to masonry adapted for the purpose, the bridges being of that extent necessary to accommodate the immense traffic connected with sea-going steamers. Some idea may be formed of the size of the stage when it is stated, that the area of deck space will amount to nearly two acres, thus giving ample space for the erection of light buildings of wood and corrugated iron, to any extent that may be required. The total displacement of all the pontoons, with a mean draft of three feet, will be 157,560 cubic feet, equal to 4,500 tons. It will take 125 tons distributed over the deck to place the stage one inch deeper in the water, or 1,500 tons to increase the depth one foot. A weight of 3,000 tons will be required to bring the tops of the pontoons to a level with the water, so that no danger need be apprehended of either overloading or overbuilding on the deck. The cost of this immense stage, the largest of the kind ever erected, will be from £110,000 to £115,000. The design was furnished by Mr. Cubitt.

Nixey's Revolving Reference Till.—In this improved modification of Mr. Nixey's former revolving till, the apparatus is constructed to be countersunk into the shop counter, so as to be flush with the surface thereof. The revolving chambers remain similar in principle to those in Mr. Nixey's first arrangement, but a slight modification has necessarily been effected in the actuating stop mechanism. Fig. 1 of our engravings represents a plan of the revolving till, and fig. 2 is a corresponding side elevation of the same. The ivory stud or button, A, is pressed down by the thumb or finger, which pushes it out of one of the six holes, B, formed in the edge of the revolving portion of the till. The button having been pushed down, the till is made to partly rotate without removing the finger from the aperture which contained the holding button. On the next succeeding hole or aperture coming over the button, the latter is forced up into it by the action of a spring, C. The magnetic base coin detector is dispensed with in this till, the whole being covered by a disc of plate glass fitted into a frame, D, which is screwed into the top of the till. A small detent spring, E, concealed under the till, serves to prevent the revolving chambers from being reversed, the end of the spring bearing against projections immediately behind each finger or stop hole.

Fig. 1.



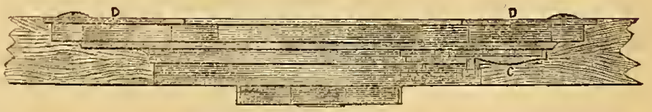


Fig. 2.

The Universal Industrial Exhibition of France.—Unfinished as it was, the French Palais de l'Industrie was formally opened by the Emperor and Empress of the French, on the 15th of May. It seems a difficult matter to follow our example in being punctual to the appointed time of unlocking these great bazaars of science and art, and now, after losing a fortnight, the Parisian collection could hardly be said to exist, except in name, when the inaugural ceremonial came off. But the show has commenced, and the authorities must now do all they can to work up its details into presentable form. The Imperial ceremony came off in a very quiet way. The Emperor, with his Empress and suite, went to the chief building of the group, and received an address from Prince Napoleon, the President of the Imperial Commission, to which the Emperor very briefly replied. The formal perambulation then took place, and the affair ended. The Exhibition buildings—for there are more than one—consist of one permanent stone structure, the Palais de l'Industrie proper, and the 'Annex,' a shed 4,000 feet in length. The latter is built in a line parallel with the Seine, and it is covered by an arched roof. It is devoted to machinery and raw produce, the higher grades of industrial production being reserved for the building in chief. These two structures are joined together by a gallery running across the Champs Elysées, and having in its centre a circular space, where will be, amongst other displays, that great essential—the refreshment room. Another shed is being added for carriages; and a separate building near the western end of the Annex, holds the Fine Arts collection. So far as can be made out amidst the present state of comparative confusion in the collection, the displays of the East India Company, that of Mr. Minton, the porcelain manufacturer of Stoke-upon-Trent, and that of the Lyons manufacturers, are the best. It is a curious, and to us a gratifying fact, that Mr. Minton has far outrivalled the great government productions of France, so long and so justly celebrated as the very essence of ceramic elegances. Great exertions are being made to push on the arrangements, and we hope that, by the time of our next monthly issue, the undertaking will have assumed such a condition as will enable us to tell something of its realities, as well as its fair promises.

Court of Inventions at the Crystal Palace.—Inventors, and those interested in inventions, will be glad to learn that the directors of the Sydenham Palace have opened a court of inventions as an addition to this magnificent exhibition, and they invite contributions of models and drawings of new inventions. The great advantages of such an arrangement are to be afforded to exhibitors free of all charge for space, the articles being, of course, delivered at the palace carriage paid. We believe many parties who were exhibitors at the recent exhibition of the Society of Arts, having had circulars addressed to them by the directors, have transferred their models and drawings to the Crystal Palace, thus availing themselves of this opportunity of keeping their inventions prominently before the public. We have no doubt that the arrangement will be received as a boon by a great number of publicity-seeking inventors, and it is to be hoped, that in the Crystal Palace the inventions will stand a chance of being seen by others than mere rival inventors, for it too often happens that few parties visit exhibitions of inventions but inventors themselves, and they are, of course, each too engrossed with his own particular models or drawings to pay much attention to rival productions.

Modern War-Gunnery.—Mr. James Dundas, of Dundas Castle, Linlithgowshire, proposes to construct cannon and large fire-arms of various kinds, on what may be termed the "barrel" principle; that is to say, he puts the guns together from a multitude of pieces, just as a cooper goes to work in constructing a cask. Fig. 1 is a longitudinal section of such a gun; and fig. 2 is a transverse section through the touch-hole. The actual bore portion of the gun, which resembles a plain tube in fig. 1, really consists of a series of "stave" pieces, as indicated in fig. 2. These pieces are planed on their edges, and built together to form a complete tube; a solid end-piece being set inside to form the breech. These staves are then hooped together into one solid mass by a series of annular pieces which are strung on the staves, and thus hold the whole together. By this means the inventor proposes to secure strength and portability; but we doubt whether he will be able to add to these points, that of accurate and satisfactory firing.

Fig. 1.

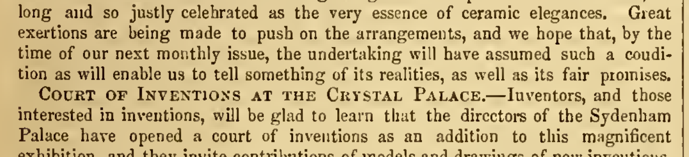
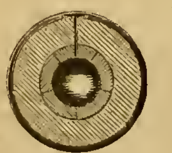


Fig. 2.



Mr. John Smith, of the establishment of Messrs. Hollis and Sheath, of Birmingham, has effected a useful improvement in the ramrod details of the "Enfield pattern" rifle, now making in such large quantities in the great Warwickshire workshop. The character of the groove in which the rod runs, and the swell on the rod itself, cause the movement to be extremely awkward in the original design. In his modification, Mr. Smith adheres to the spring as formerly used, but he overcomes the objectionable action of the screw in coming in contact with the spring, by attaching a small roller to the latter. In this way, whilst the retention of the rod in due position is fully effected, it may be readily withdrawn, the stock being in no way weakened, nor the screw injured.

Captain Norton has been progressing favourably with his iron shot trials, both with rifle muskets and rifle nine-pounder field guns. The sketches, figs. 3, 4, 5, and 6, represent his new rifle fire shot or "spinster" shot. Fig. 3 is a view of the missile, representing its hollow base prior to the slow match being screwed in. Fig. 4 is the coarse thread screw, with the layers of slow match attached. Fig. 5 is the shot complete for use; and fig. 6 is the appearance of the shot after it has passed thirteen inches into hard deal plank, at twenty yards. This last view shows how completely the shot has received the impressions of the rifle grooves due to the expansive power of the exploding charge. The four projections on the cylindrical sides of the shot are only slightly elevated, so that the shot may enter the rifle very freely. They have a sufficient hold in the grooves of the rifle to insure the rotatory motion round the long axis of the shot, when but a small charge of powder is used. The weight of the spinster with screw and slow match is $1\frac{3}{4}$ ounces, and the charge is $3\frac{1}{2}$ drachms of Hall's rifle powder. The extreme range is 1800 yards. This fire shot, made of iron, may be filled with Valenciennes composition, so as to burn with intense heat after entering the object at which it is fired. The iron of the shot becoming red-hot, is thus much more efficient than the present red-hot shot. Hence, all the danger and inconvenience of shot-heating furnaces may be avoided.

Fig. 3.

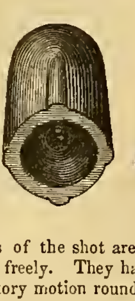


Fig. 4.

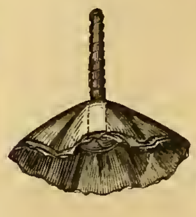


Fig. 5.

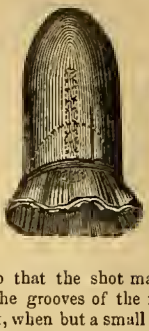
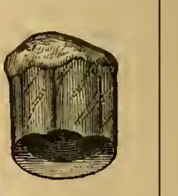


Fig. 6.



America.—The Land of Wooden Clocks.—Connecticut has invested a million dollars in the wooden clock manufacture. In turning over this capital, 1300 hands are employed, producing nearly 800,000 clocks a year. Bristol possesses fourteen clock factories, containing 400 hands, who annually turn out 200,000 clocks. Plymouth contains three such factories or clock mills, with 175 hands, and manufactures 70,000 clocks annually. Ansonia has two factories, with 140 hands, producing 102,000 clocks a year. Winstead possesses but a single factory, with 40 hands, making 30,000 clocks a year. Southampton has two factories, and 45 hands, producing 40,000 clocks a year; and New Haven with three factories, and 400 hands, annually contributes rather more than 370,000 clocks.

Miles' Hydrostatic Railway Brake.—The Shrewsbury and Hereford Railway has just been the scene of an interesting trial of this invention, under the auspices of several eminent railway authorities and men of science. The testing train left the Shrewsbury station at 12.30, arrived at the city at 2.40, stopping at the usual stations on its way. The patent brake alone was used during the journey, and upon the arrival of the train at this station, a number of experiments were tried upon different portions of railway, principally to ascertain the distance and time in which a train could be arrested. Notwithstanding the usual drawbacks to working all new inventions, the train was easily stopped, when going forty miles per hour, in 300 yards, the usual distance with the ordinary brakes being about 1750 yards. Colonel Kennedy and other gentlemen, who tried these tests, expressed a strong opinion that, with the slight enlargement of the tender cylinder, pointed out by Mr. Miles, a train would be stopped with ease in three yards to the mile; that is to say, a train going forty miles per hour would stop in 120 yards. The experimental train left this city, with the usual mails and passengers, at 6.45, and arrived at Shrewsbury at 9.15, using the patent brake during its course, still proving itself most effective. The brakes themselves are upon the usual principle, but are placed upon every carriage, instead of on one or two only. A cylinder is fixed under the carriage, $4\frac{1}{2}$ inches diameter and 3 inches stroke; and in this cylinder is fitted a solid piston, the rod of which is attached to the lever of the brake. Into each side of the cylinder is screwed an iron tube, one inch in diameter, and terminating, at each end of the carriage, with a joint of a novel character. When the carriages are connected, the tubes are made continuous by inserting into these joints a flexible tube between each carriage; and when the engine is attached to the train, that is also connected by a flexible tube, leading into tubes fixed in the bottom of the tender, which tubes are merely for the purpose of reducing the temperature of the water used in applying the brakes. The boiler is fitted with a stopcock near the starting lever, and from this cock is a tube connected to the tubes in the tender. When a train is made up, and the engine attached, a cock inside the tender is opened, and the tubes throughout the train are allowed to fill themselves with water; water being only compressable to the extent of 1 inch in 15,000, is always ready to be acted upon at the moment. At the present day, locomotives are worked at a pressure of from 100 to 150 lbs. per square inch; but for example's sake, we will take the lowest figure, therefore, with the cylinders before described, a power of 1500 lbs. is given to each brake, no matter what may be the number of carriages in the train. The cylinder to work the tender brake is $4\frac{1}{2}$ inches diameter, with a 6 inch stroke, and gives a force of 3000 lbs. The mode of bringing the brakes into use is this:—The engine driver shuts off his steam, opens the cock named in boiler, and in one second, the whole of the brakes are on the wheels, and are taken off by the driver shutting the cock in the boiler, and opening the one in the tender.

Scott's Elastic Action Three-Wheel Brougham.—Mr. Michael Scott, C.E., who has devoted considerable attention to the perfecting of the details of vehicular contrivances—more especially the parts relating to the springs and bearings—has submitted to us a plan of "three-wheel Brougham," of very suggestive character. This carriage is designed for affording superior facility of motion, with ease and accomodation to the occupants, and means of resisting the wear and tear of traffic. It has two wheels behind, and a single central wheel in front, as high or even higher than the hind pair. This lightens the draught and simplifies the under frame-work. The driver's seat occupies the place usually assigned to the rumble, directly over the hind wheels, so that the reins stretch over the body of the carriage, as in the Hansom. This obviously leaves the front view quite open and free. In arranging the details of the bearing actions, Mr. Scott uses a "semi-circular spring"—the extreme ends of which, together with the spring blocks, are wholly disconnected—producing great elasticity. His "elastic nave," is also a further means of obtaining an easy action. The mortice heds, or the portions on which the inserted wooden spoke-ends bear, are cushioned with india-rubber. India-rubber is also used for encircling the felloes of the wheel, either in strips as an independent tyre, or in small blocks or cushions between the wooden felloe and the ordinary metal tyre. The inventor has contrived to elasticate various other rigid parts of the carriage, even the axle itself, as well as the shoes of the horses.

Law Reports in Patents—Gutta Percha Shoes—Martin and Hyam's Patent—Opposition.—This was a petition, praying that letters patent might be sealed to the petitioners for an invention of improvements in goloshes, or over-shoes. It appeared that the invention claimed by the petitioners consisted in forming the golosh or overshoe of gutta percha, in such a manner as that it should adhere to the foot, but cover those parts only of the shoe or boot requiring to be protected,—namely, the toe, the heel, and the sides at the junction with the uppers, such golosh or overshoe being of a shape and material admitting of its being manufactured on a wooden last; so that, in the result, a lighter, cheaper, and more economical golosh was produced than before. The application for the patent was in the first instance referred to the Solicitor-General, who, after hearing the opposition of the Gutta Percha Company, and Mr. Nickels, the well-known elastic fabric manufacturer, granted his warrant for the sealing of the letters patent. The Gutta Percha Company have since withdrawn their opposition, but Mr. Nickels renewed his objection to the sealing of the patent, on the ground that the alleged invention was not a novelty. The Lord Chancellor, without calling for a reply, said that the person opposing the sealing of the patent had failed in making out his case. Leaving, therefore, the parties to their rights at law, he should order the seal to be affixed to the patent, and direct Mr. Nickels to pay the costs incurred through his opposition.

Governmental Education, Science and Art.—The sum required, according to the fourth part of the estimates of Civil services, for the purposes of education, science, and art, in the year 1855, amounts to £816,323, being an increase of £92,913 as compared with 1854. Of this sum £381,000 is required for public education in Great Britain; £215,200 for education in Ireland; £79,364 for the board of trade (department of science and art); £3,858 for the University of London; £7,952 for universities in Scotland; £2,366 for the Queen's University in Ireland; £9,552 for the Queen's Colleges in Ireland; £2,600 for the Belfast theological professors; £56,180 for the British Museum establishment; £27,520 for the buildings of the same, and £4,000 for purchases; £17,696 for the National Gallery, including purchases of pictures; £500 for the Royal Geographical Society; and £6,409 for scientific experiments.

The French Beet Sugar Manufacture.—There are now at work in France 203 beet sugar manufactories, being fewer by 95 than were in operation last year at the same time. The quantity of sugar manufactured, including 7,870,605 kilogrammes, lying over since 1854, was 43,229,793 kilogrammes, or 30,921,340 less than last season; and that sold for consumption, or deposited in the Government bonded stores, 39,659,690 kilogrammes, being a falling off of 23,591,362 kilogrammes.

Restoration of the Standard Weights and Measures.—A valuable report has been prepared by Professor Airy, Sir John Herschel, Sir J. W. Lubbock, and Mr. Bethune, aided by some other scientific men, on the important subject of the restoration of our standards of weight and measure. In this document the commissioners first describe the state of the standards recovered from the ruins of the House of Commons, as ascertained on their inspection of the 1st of June, 1838, and then enter into minute details of the course to be adopted for the definition and restoration of the standards. With respect to the definition, they are of opinion that that contained in the act of the 5th of Geo. IV., chap. 7th, sects. 1 and 2, by which the standard yard and pound are declared to be respectively a certain brass rod and a certain brass weight therein specified, is the best that can be adopted. With respect to the provisions for restoration, they are not prepared to recommend the adoption of those prescribed by sects. 3 and 5 of the same act, but they suggest that so much of the said act as provides for the restoration of the standards, in the manner therein mentioned, be repealed, and that the standard of length be defined in subsequent enactments, either by the whole length of a certain piece of metal supported in a certain manner at a certain temperature, or by the distance between two points or lines engraved upon the surface of a certain piece of metal, and that the standard be in no way defined by reference to any natural basis, such as the length of a degree of meridian on the earth's surface in an assigned latitude, or the length of the pendulum vibrating seconds in a specified place. They recommend, secondly, that the standard of weight be defined by a a certain piece of metal; and, thirdly, that the standard of capacity be defined by the capacity which, under certain circumstances of the barometer and thermometer, contains a certain weight of distilled water, but that it be in no way defined by reference to the standard of length. The commission proceed to recommend that the avoirdupois pound be adopted instead of the troy pound as the standard of weight; and also (though not with absolute unanimity), that no change be made in the values of the primary units of the weights and measures of this kingdom, or in the meaning of the names by which they are commonly denoted. As regards the decimal scale, the commissioners are in favour of establishing a decimal coinage, but adverse to enforcing it exclusively in all parts of the various scales of weights and measures. They think that the scale of binary subdivision is well adapted to small retail transactions, but that the decimal scale is by far the most convenient for all transactions which become the subject of written accounts. A recommendation is also made to introduce the use of the decimal subdivisions of the acre in land measuring, and to compute and prepare a new edition of certain tables (for the reduction of assays of the precious metals) in which the larger weights shall be expressed by decimal multiples of the troy ounce, to the entire exclusion of the troy pound, measures being at the same time taken for the ultimate removal of the troy scale and the adoption of a decimal scale. The report concludes with suggestions with regard to the verification of local standards, and the means to be adopted for facilitating the introduction of a uniform system of weights and measures, and for reconciling the habits of the people to so considerable a change.

Marine Memoranda.—Progress of Screw Propulsion.—Some 12 months ago, when our troops were *en route* for Turkey, a proposal was made to the Government that a ship mill and bakery should accompany the expedition, with a view of supplying the soldiers with good, wholesome bread, such as they had been accustomed to in this country. The project was certainly novel, and attended with considerable difficulty, arising from the ever-varying levels produced by the ship's motion, from the dangers which beset the brick-work of the ovens by concussions, and from the straining of the vessel in a heavy sea. These difficulties were, however, surmounted, and designs for carrying out the undertaking submitted to the Government and approved; but Lord Raglan and Commissary General Filder, when at Gallipoli, having expressed an opinion that the local resources of the country would be found adequate to the wants of the army, the execution of the project was deferred. The proposition was advocated on the grounds that the navigable waters of the Black Sea would necessarily form the base of all our military operations, and be the great highway for conveying supplies to the army, while its shores would naturally become the rendezvous of invalids, to whom good bread is indispensable, and of reinforcements arriving, so that there would, under any circumstances, be always a considerable force to be victualled on the seaboard; and, were it otherwise, the vessels might have been profitably employed in manufacturing biscuit on the spot without incurring the expense of transporting wheat to this country to be returned in biscuit. These suppositions have since been verified—lamentably so as regards the sick—and the state of suffering to which our troops have been exposed in the Crimea led to a demand being sent to this country, to fit out two steam vessels for this service with all practicable despatch. For this object Messrs. Fairbairn were consulted, and in two months they converted Her Majesty's ship *Bruiser* into a complete flourmill, capable of grinding from 700 to 800 bushels of wheat *per diem*, taking the raw material in at one end of the vessel in the form of wheat, and turning it out at the other in well-manufactured flour, without the intervention of manual labour. The machinery is both ingenious and compact, and in moderate weather may be worked without suspending the progress of the vessel, notwithstanding it is all driven by the marine engine. The *Abundance*, a companion vessel, has in like manner been fitted up as a large bakery by Messrs. Swaine and Bovill, of Millwall, and is capable of turning out 20,000 lb. of bread *per diem* with the aid of some very simple machinery. The bakehouse in this vessel possesses the great advantage of thorough ventilation, the hot air being withdrawn at pleasure by mechanical means, and as often replaced by fresh, which, in a warm climate, is an important consideration.

The "P. and O. Company," as it is often familiarly called, has been trying a large matter-of-fact experiment as to the relative practical value of the paddle wheel and screw for marine propulsion. The test was carried out by altering the *Sultan*, a vessel built for them, from a paddle wheel to a screw ship. The *Sultan* is an iron ship of 1,200 tons burden, originally fitted with engines of 420-horse power. The alterations now made in the vessel have caused the old machinery to be entirely discarded, and in its place engines of only 210-horse power have been supplied by Messrs. Summers and Day of Southampton, with Lamb and Summers' patent flue-boilers. An opportunity was here afforded of exhibiting the difference in speed caused by the alteration, not only in the method of propulsion, but in the power of the machinery. The experiment has not only been successful, but the result is sufficiently extraordinary to merit the attention of scientific men. At the official trial trip of the *Sultan* in 1851 with paddle-wheel engines of 420-horse power, the average speed was 10·714 knots an hour. With the new engines, which are precisely half the power of the old ones, but driving a screw, the average speed under steam alone has been 10·47 knots, and with a light breeze and the fore and aft canvas set, 11·004 knots, the former being very nearly equal to the speed gained when the ship was driven through the water by paddle wheel engines of such enormously disproportionate force. The slight and almost insignificant difference in speed is not the only advantage gained by the novel change. In place of carrying only eight days' coals as heretofore, the *Sultan* can now stow fuel for 16 days' consumption, has greater accommodation for passengers, and can take 150 to 200 tons more cargo than it was possible to carry before. With this combination of advantages, added to the fact that the wear and tear and working expenses of the ship are proportionately reduced, it is no marvel that the experiment has been regarded with much interest, as being one never before attempted. The new screw ship *Sultan* is to be placed on the Southampton, Malta, and Alexandria station.

The steamers now on the station between Dover, Calais, and Ostend. are the *Empress* (L'Impératrice), 308 tons, 100-horse power, new vessel; *Queen* (La Reine), 308 tons, 100-horse power, new vessel; *Ondine*, 280 tons, 70-horse power; *Violet*, 300 tons, 128-horse power; *Onyx*, 300 tons, 128-horse power; *Dover*, 260 tons, 108-horse power. The two first are new vessels, and have made the most rapid passages. The *Empress* has run from Boulogne to Dover in 1 hour and 41 minutes; the *Queen* lately took the mail and 40 passengers to Calais in 86 minutes. These two vessels run between Dover and Calais, making one passago to and from daily. The *Onyx* and *Violet* run between Dover and Ostend alternate weeks.

Messrs. W. C. Miller and Sons, of Liverpool, have lately launched a thoroughly iron screw steamer, designed by Mr. James Hodgson, for the London and Eastern Archipelago Company. She is built on the tubular principle, and possesses the novelty of having neither wooden floors nor frames. Her plating is carried continuously throughout, so as to form an immensely strong iron deck, without any wood-work whatever.

PURIFYING RANCID OIL.—It has recently been discovered in France, that nitric ether, commonly known as "spirits of nitre," has a powerful effect in clearing and deodorising impure oils. A small quantity mixed with the crude oil carries off all the disagreeable odour, whilst, by subsequently warming the oil so treated, the spirituous ingredient is renewed, and the oil becomes sweet and limpid. A few drops of nitric ether added to the contents of an oil bottle, will act as a constant preventive to rancidity.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded February 15.

343. Benjamin Gower, Stratford—Improvements in cannons and pieces of ordnance, and in shot and projectiles for cannons and pieces of ordnance.

Recorded February 23.

400. John Norton, Dublin—Improvements in the construction of cartridges for fire-arms.

Recorded March 1.

456. Thomas Kennedy, Kilmarnock—Improvements in wadding for fire-arms.

Recorded March 5.

491. Charles L. Fowle, Massachusetts, U.S.—New and useful improvements in machinery for sewing cloth, leather, or other material.—(Communication.)

Recorded March 6.

496. Perceval M. Parsons, Duke-street, Adelphi—Certain improvements in fire-arms and projectiles.

Recorded March 7.

506. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture of hard india-rubber, and of articles composed of that material.—(Communication from Charles Morey, Paris.)

Recorded March 9.

539. William Smith, 10 Salisbury-street, Adelphi—Invention of safety harness.—(Communication.)

Recorded March 14.

572. Edward V. Gardner, 24 Norfolk-street, Middlesex Hospital—Improvements in furnaces, ashpits, flues, and fireplaces, whereby smoke is prevented, fuel more perfectly consumed, and its heating value greatly economized.

Recorded March 15.

583. Nathan Robinson, John Lister, and Henry Stevenson, all of Bradford—Improvements in looms for weaving cocoa-nut matting and similar fabrics.

Recorded March 26.

657. Jean B. Dechanet and Antoine D. Sisco, both of Paris—Improvements in the process of manufacturing metallic tubes and pipes, and in the machines or apparatus used for that purpose.
659. John Gedge, 4 Wellington-street South, Strand—Improvements in the manufacture of gloves.—(Communication.)
661. John Britten, Birmingham—A new or improved machine for sweeping or cleaning chimneys.
663. John M'Kinnell, Glasgow—Improvements in ventilation.
665. William Bartlett, Bradford-street, Birmingham—Certain improvements in ventilators.
669. Oliver R. Burnham, New York—Improvements in the construction of projectiles.
671. John Marland, Leeds—Improvements in preparing for and in sizing and warping woollen and worsted yarn.
672. Carl Armbruster, Andermach, Rhenish Prussia, and Otto Laist, Pfeddersheim, Grand Duchy of Hesse—Improvements in the manufacture of sulphate of soda.
673. John Shaw, Lees, Lewis Harrop, Oldham, and James Fielding, Lees, Lancashire—Improvements in machinery for spinning and doubling cotton and other fibrous materials.

Recorded March 27.

675. John Gedge, 4 Wellington-street South, Strand—Improvements in the mode or modes of transferring designs on to woven textile or other fabrics, or on paper, and in the machinery used for such purposes.—(Communication.)
677. Charles Goodyear, 42 Avenue Gabriel, Champ Elysées, Paris—Invention of a new method of moulding india-rubber and gutta percha.—(Communication.)
679. Archibald Turner, Leicester—Improvements in the manufacture of elastic fabrics.

Recorded March 28.

681. Francis G. Mulholland, 44 Vincent-square—An improved mode of constructing fire-proof and water-proof roofing, flooring, and covering for general purposes.
683. James Higgin, Manchester—Invention of the use of a thickener for mordants and colours for printing woven fabrics, which thickener has not been hitherto used for such purposes.
685. William Hutchison, Tonbridge Wells—Improvements in manufacturing artificial stone, and in giving colour to the same.
687. Joseph Revell, Dukinfield, Cheshire—Certain improvements in machinery or apparatus for propelling vessels.
689. George H. Nicoll, Dundee—Improvements in laundry stoves.
691. William H. Gauntlett, Banbury, Oxfordshire—Improvements in apparatus for cutting or pulping turnips and other roots.

Recorded March 29.

693. Frederick W. Mowbray, Shipley, near Leeds—Improvements in bearings for the axles of railway wheels, and of other axles or shafts, which improvements are also applicable to axles or shafts, and other like rubbing surfaces.
695. François J. Anger, 16 Stamford-street, Blackfriars-road—Improvements in the preservation of vegetable substances.
697. Walter Brown, 5 Catherine-street, Cornwall-road, Lambeth—Improvements in the manufacture of sheet metal casks and kegs.
699. Alexander M'Dougall, Manchester—An improved method of consuming smoke in steam engine or other furnaces or fireplaces.
701. Alexander Dalgetty, Deptford—Improvements in steam engines.
703. Robert Johnson, William W. Johnson, and Robert Johnson, the younger, 4 Waterloo-place, Commercial-road, Limehouse—A new and improved covering for surfaces, linings, roofs, and spaces.

Recorded March 30.

705. Anatole Bère, Lille, France, and 4 South-street, Finsbury—Improvements in steam boilers.
707. William Crozier, Sunderland—Invention for the better extinction of fire.
709. William Tytherleigh, Birmingham—Invention of the application of a certain well-known process to the covering of iron in sheets or bars with copper or copper alloys, whereby be produces a new and useful product.
711. Manning Prentice, Stowmarket, and Thomas Richardson, Newcastle-on-Tyne—Improvements in the manufacture of manures.
713. Manning Prentice, Stowmarket, and Thomas Richardson, Newcastle-upon-Tyne—Improvements in the manufacture of manures.
715. Theophilus W. Bunning, Newcastle-upon-Tyne—An improvement in steam engines.

Recorded March 31.

717. Andrew Shanks, 6 Robert-street, Adelphi—Certain improvements in band-drilling machines.
719. John B. Surgey, Lidlington-place, St. Pancras—Improvements in instruments for threading needles.
721. Robert Hardman, Bolton-le-Moors, Lancashire—Certain improvements in looms for weaving.
725. Thomas R. Crampton, Adelphi—Improvements in locomotive and other steam boiler furnaces.—(Communication.)
727. Thomas Hedgcock, 7 Cavendish-grove, Wandsworth-road—An improved quadrant for taking solar altitudes for latitude without aid of marine horizon, and for ascertaining the true longitude.

Recorded April 2.

729. Frederick Phillips, The Hall Farm, Downham, near Brandon—Improvements in machinery or apparatus for distributing manure, sowing or depositing seeds, and effecting the working and cultivation of land.
731. John Taylor, Spring-grove, Hounslow—An improvement in the manufacture of covers for books.
733. Robert S. Newall, Gateshead-on-Tyne—An improvement in the standing rigging of ships and other vessels.
735. George W. Friend, 22 High Holborn—Improvements in umbrellas and parasols.

Recorded April 3.

737. François T. Botta, Paris—Improvements in the method of and apparatus for beer brewing.
739. Henry Chapman, Kingsland—An improved electro-mechanical apparatus for supplying and adjusting the electrodes used in the production of the electric light.
741. Peter R. Jackson, Salford—Improvements in machinery for making patterns, and for moulding therefrom.
743. William H. Tooth, 2 Pilgrim-street, Kennington-lane, Lambeth—Certain improvements in the construction of floating vessels, and in the machinery and steam signals connected therewith, and in the application thereof to other purposes.
747. James Cowen, Greycoat-street, and James Sweetlong, Earl-street, Westminster—Invention of a locomotive land battery.
749. Frederick Joyce, Upper Thames-street—Improvements in the manufacture of percussion caps and other primers.
751. Samuel Greenwood, Sunderland—Improvements in machinery for making rivets, bolts, nuts, and other similar articles.

Recorded April 4.

753. John Crowley, Sheffield—Improvements in the manufacture of malleable cast-iron.
755. Louis A. M. Mouchel, Paris, and 166 Fleet-street—An improved method of joining pipes, tubes, and ducts.—(Communication.)

Recorded April 5.

757. William Goostrey, George Hulme, and Charles Hough, Chedderton, Staffordshire—Improvements in machinery or apparatus for manufacturing paper.
759. James Chesterman, Sheffield—Improvements in the manufacture of table and other like knives.
761. Charles Goodyear, Paris—Improvements in self-inflating pontoons and life-preservers.
763. Joseph E. Frost, 135 Goswell-street—An improvement in ball or float cocks.
765. Herbert M. Holmes, Derby—Improvements in the manufacture of tyres for wheels.
767. Anguish H. A. Durant, Tong Castle, Salop—An improved axle and axle-box for carriage wheels, shafts, axles, or general bearings of machinery.

Recorded April 7.

769. William B. Hays, 47 Cambridge-street, Pimlico—An improved breakwater.
771. Henry Gerner, Moorgate-street—Improvements in polygraphic writing and drawing apparatus.
773. Joseph Hull, Liverpool—Improvements in the machinery and apparatus for grinding corn.
775. Richard Husband and George Mallinson, Manchester—An improvement in the manufacture of hat plush.
777. George Walker, Belfast—An improvement in power-looms.

Recorded April 9.

778. James C. Kay, Bury—Improvements in the construction of pressure and vacuum guages.
779. William Tuer, William Hodgson, Robert Hall, and Samuel Hall, all of Bury—Certain improvements in looms for weaving.
780. Edward O'Callaghan, Lieutenant in her Majesty's 51st Light Infantry—Improvements in ordnance, and in projectiles applicable to ordnance and small arms.
781. David Cope, Birmingham—Improvements in the manufacture of metallic spoons forks, and ladles.

782. William Bull, Ramsey, Essex—An improved instrument for cutting or slicing turnips and other vegetables.
783. Anguste E. L. Bellford, Essex-street, Strand—Improvements in pumps.—(Communication from John H. M'Gowan, jun., Cincinnsti, U. S.)

Recorded April 10.

784. William Ricketts and Thomas Bulley, both of Stepney—Improvements in producing ornamental designs on painted or japanned table-covers.
785. Samuel Fieldiug, younger of Green, Rochdale, Lancashire—Improvements in apparatus for oiling or lubricating the pistons of steam engines.
786. Peter Armand le Comte Fontaine Moreau, 4 South-street, Finsbury, and 39 Rue de l'Exchiqnier, Paris—Certain improvements in the construction of steam boilers.—(Communication.)
787. Alexander Chaplin, Glasgow—Improvements in steam boilers, and in the combustion of fuel.
788. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for combing wool and other fibrous substances.—(Communication from Victor Brosser, Beauvais, France.)
789. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for preparing cotton and other fibrous substances.—(Communication from Jean Bengger, Wülflingen, Switzerland.)
790. Lonisa Monzani, St. James's-terrace, Blue Anchor-road, Bermondsey—Improvements in folding-stools and folding-chairs.—(Communication from her late husband.)
791. Lord Charles Beanclerk, Riding, Northumberland—Improvements in machinery for tilling and subsoil ploughing.

Recorded April 11.

792. Jonathan Edge, Bolton-le-Moors, Lancashire—Improvements in steam engines.
793. John Addisnn, 23 Basinghall-street, and Duncan Sinclair, 122 Oxford-street—Improvements in the manufacture of bayonet scabbards, sword scabbards, pistol cases, and holsters.
794. Charles Blunt, Wanstead, Essex, and Joseph J. W. Watson, Wandsworth, Surrey—Improvements in the composition of artificial fuel, with the machinery employed in the manufacture thereof.
795. Leopold Ondry and Alphonse Ondry, Paris, and 4 South-street, Finsbury—Certain improvements in preserving wood, metal, and other substances.
796. John Alderman, Denmark-street—Improvements in the construction of adjustable couches, chairs, and other similar descriptions of furniture for invalids.
797. James Fletcher, Facit, near Rochdale—Improvements in and applicable to machines for spinning and weaving cotton, wool, and other fibrous materials.
798. Frederick S. Hemming, Birkenbead—Improvements in the construction of buildings, which improvements are particularly applicable to military and other hospitals.
799. Jean V. M. Dopter, Paris, and 32 Essex-street, Strand—Certain improvements in printing fabrics.
801. Samnel Holt, Shaw Heath, Stockport—Improvements in weaving plush or piled fabrics.
802. George F. Wilson, Conrad A. Hanson, and James J. Wallis, all of Belmont, Vauxhall—Improvements in the manufacture of lamp candles, and in candle lamps for holding the same.
803. Philippe A. Devy, 10 Old Jewry Chambers, Old Jewry—Improvements in the construction of coke ovens.—(Communication.)
804. George F. Wilson and George Payne, Belmont, Vauxhall—An improvement in ornamenting glass.
805. James L. Norton, Holland-street, Blackfriars—Improvements in separating wool and other animal fibres from vegetable matters, and in drying wool and other animal fibres.

Recorded April 12.

809. Alfred T. Richardson and George Mallinson, Manchester—Improvements in the manufacture of certain piled fabrics.
810. Ferdinand Wilhelmy, Dusseldoy, Prussia—Invention of border paddles for steamboat wheels.
811. Isaiah Vernon, West Bromwich, Staffordshire—An improvement or improvements in the slide valves of steam engines.
812. William Terry, Francis-street, Aston, Birmingham—Improvements appertaining to breech-loading fire-arms.
813. Alexander Cnningbame, Glasgow—Improvements in the manufacture or production of sulphuric acid and sulphates of iron and alumina.
814. Jules Laleman, Lille, France—Improved machinery for combing flax and other similar fibrous materials.—(Communication.)

Recorded April 13.

815. Jean B. Bagary and Clande Perron, Paris, and 32 Essex-street, Strand—Invention of new or improved knitting machinery.
816. James Templeton, Glasgow—Improvements in the manufacture of pile fabrics.
818. Joseph Revell, Dukinfield, Chester—Certain improvements in machinery or apparatus for propelling vessels.
819. Thomas Wimpenny, Holmfirth, Yorkshire, and Jonas Wimpenny, Rawtenstall, Lancashire—Certain improvements in machinery or apparatus for drawing and spinning wool, or wool mixed with other fibrous substances.
820. John Jarman, Masborough, Yorkshire—Improvements in horse shoes.
821. Richard A. Brooman, 166 Fleet-street—Improvements in the treatment of fatty and resinous matters, and in preparing them for the manufacture of candles and other articles.—(Communication.)
822. Thomas Hill, Walsall—Improvements in the manufacture of horse-shoe and other nails.—(Communication.)
823. George Tnrner, Northfleet, Kent—Certain improvements in the construction and fitting of tents and marquees.

Recorded April 14.

824. Jnles Denoual, Samares-lodge, St. Clements, Jersey—Certain improved means of enveloping medicinal preparations with soluble substances.
825. Joseph Armstrong, Wakefield, and John Livingston, Leeds—Improvements in certain parts of the permanent way of railways.
826. William Gossage, Widnes, Lancashire—Improvements in the manufacture of certain kinds of soap.
827. Jane A. Herbert, 5 Waterden-place, Guildford—Improvements in propellers for vessels, which are denominated the conical propellers.—(Communication.)
828. William Reid, Holehouse, Neilston, Renfrewshire—Improvements in the treatment, cleansing, starching, and finishing of textile fabrics.
829. Thomas Kennedy, Kilmarnock—Improvements in shot or projectiles.
830. Gustave I. Sculfort, Mauberge, France—An improvement in screw-wrenches.

Recorded April 16.

831. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and Paris—Improvements in the production of a felted tissue, applicable to replacing leather in the manufacture of cards.—(Communication.)
832. Rowland M. Ordish, Copeuhagen—Certain improvements in the permanent way of railways.
833. Richard Hnsband, Manchester—Certain improvements in the manufacture of "hat plushes" of spun silk and other spun yarns.
834. Henry Holmes, Clifton-road, Maida-vale, Middlesex—Invention of certain processes of treating the human body by gases, vapours, and electricity, and for certain apparatus for obtaining and applying the said gases, vapours, and electricity to the above or any other purposes.
835. Edward H. Beutall, Heybridge, Essex—An improvement in the construction of barrows.
836. John Cowley, Quennington Paper Mills, Gloucestershire, and Daniel P. Sullivan, Stockwell, Surrey—Improvements in the manufacture of paper.
837. George Baird, Birmingham—An improved label and stamp setter.
838. William Bull, Lupus-street, Belgrave-road, Pimlico—Improvements in bearings, bushes, and other surfaces, in or upon which shafts, axles, or other bodies move or revolve; also in the said shafts, axles, and other moving or revolving bodies.

Recorded April 17.

839. Arthur W. Callen, Camberwell, Joseph West, Guernsey, and George W. Lewis, Bristol, U.S.—Improvements in the construction and fittings of tents, especially suitable for military purposes.
840. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and Paris—Certain improved machinery for manufacturing nails, bolts, rivets, and other similar articles.—(Communication.)
841. Philippe A. Devy, 10 Old Jewry Chambers, Old Jewry—Improvements in the frames of swing looking-glasses.—(Communication.)
842. Robert Milligan, Harden, Bingley, Yorkshire—An improvement in the manufacture of woven fabrics made of wool, mohair, or alpaca.
843. George F. Wilsou, Belmont, Vauxhall, and Warren de la Rue, Buuhill-row—Improvements in combining fluids to be burned in lamps.
844. Charles Crapelet, 4 Rue des Fossés, Montmartre, Paris—Improvements in the construction of tompions for cannon and other fire-arms, which improvements are applicable to stopping bottles and other vessels.
845. Edward E. Alleu, 376 Strand—Improvements in steam engines.
846. Philip Levy, Edinburgh—An improved wrapper for travelling and personal wear.
847. Robert C. Clapham, Ardrossan—Improvements in the manufacture or production of the salts of baryta and of artificial iron pyrites, and in the application thereof in the manufacture or production of salts of soda or other alkaline salts.
848. Cranston Foster, Warrington, Lancashire—Certain improvements in effecting communication by signals upon railways, and in the apparatus connected therewith.

Recorded April 18.

849. Henry Woodhouse, Stafford—Improvements in the construction of crossings for the permanent way of railways.
850. Frederick L. H. Danchell, 4 Arthur-terrace, Caledonian-road—Improvements in apparatus for increasing, exhausting, or regulating fluids, and indicating pressure.
851. Louis Dameron, Paris, and 4 South-street, Finsbury—Improvements in the construction of carriages.
852. John Fordred, Hampstead—Improvements in the production of reflecting surfaces, and in the application of reflecting surfaces to decorative and useful purposes.
853. John Kay, Bonhill, Dumbartonshire—Improvements in preparing and printing textile fabrics and other surfaces.
854. Richard Bridge, Chaddertou, Lancashire—Certain improvements in power-looms.
855. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for moulding and casting fusible or plastic materials, and in covering or coating articles with such materials.—(Communication.)
856. Benjamin Cook, Birmingham—Certain improvements in the construction of horseshoes, and which said improvements are also applicable to the shoeing of asses, mules, and oxen, when such are used as animals of draught, such shoes being applied in each case without the use of nails.
857. William Madeley and Thomas Hanlon, Manchester—An improvement in or applicable to power looms.
858. John Lawson and Somerville Dear, Leeds—Improvements in machinery for combing and cleaning flax, tow, wool, and cotton, and other fibrous substances.
859. Frederick Russell, 13 Cumberland Market, Regent's-park—Improvements in hanging window sashes.
861. William V. Edwards, Swindon, Wiltshire—An improved economic portable boiler and cooking apparatus.

Recorded April 19.

862. Dumont Pallier and Edward Taylor, Broad-street, Lambeth—Improvements in the manufacture of soap.
863. Thomas Lees, Birmingham—An improvement or improvements in metallic pens.
864. Edward Howes and Walter Howes, Birmingham—Improvements in carriage lamps.
866. James Hindle, Accrington, Lancashire—Improvements in machinery or apparatus
867. William Bishop, Old Fish-street-hill, Upper Thames-street—An improved mode of ornamenting writing papers.
used in the process of printing woven fabrics.
868. Alfred V. Newton, 66 Chancery-lane—Improved machinery for crushing and grinding mineral and other substances.—(Communication.)
870. William Jones, Rbodes, near Middleton—Improvements in printing calico and other fabrics.
871. Peter Lear, Boston, U.S.—An improved method of arranging and operating horizontal submerged propellers.
872. François Jacot, Paris—An improvement in the manufacture of starch, and in obtaining and treating the gluten.
873. William Savory, Glouccster—Improvements in machinery for crushing grain and other substances, and for cutting chaff.
874. John Atherton, William Boyes, and William Lancaster, Preston—Improvements in temples employed in the manufacture of textile fabrics.
875. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture of articles of hard india-rubber or gutta percha, or compounds thereof, and in coating or covering articles with the like materials.—(Communication.)
876. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in railway breaks.—(Communication.)

Recorded April 20.

877. John C. Pierce, Bowling Iron Works, near Bradford—Improvements in making the joints of pipes and other articles.
878. Lucien Tardieu, Paris, and 4 South-street, Finsbury—Invention of a new mode of producing letters and figures for signs, show-boards, fronts of shops, houses, and other places.
879. William Ryder, Bolton-le-Moors, Lancashire—Improvements in certain parts of machinery for slubbing and roving cotton and other fibrous substances.
880. Hypolite Macé, Paris—Improvements in transferring colours or metals in design on and from paper and stone on to surfaces.—(Communication from L. A. C. Macé, Paris.)

881. Claude L. V. Maurice, St. Etienne, France—Certain improvements in carbonizing coal, and in apparatus to be employed therein.
882. James A. Manning, Inner Temple—Improvements in effecting the agitation of fluids, and solid matters contained therein.
883. John Lord, Rochdale—Improvements in temples for power looms.
884. Samuel C. Lister, Bradford—Improvements in treating the rhea plant, so as better to prepare its fibres before being spun.
885. Horatio Allen, New York—Improvements in the valves of steam and other engines.
886. Richard Bright, Bruton-street, Westminster—Improvements in lamps, and in lamp-wicks.
887. William L. Bennett, Wolston, Warwickshire—An improvement or improvements in seed drills.
888. Alfred V. Newton, 66 Chancery-lane—Improved machinery for manufacturing bolts, and other like articles.—(Communication.)

Recorded April 21

889. John Drury, Paddock, near Huddersfield—Improvements in steam-boilers for preventing explosion thereof.
890. Edwin Pettitt, Manchester—Improvements in preparing and spinning cotton and other fibrous substances, and in machinery for such purposes.
891. William Gerhardi, Manchester—Improvements in apparatus to prevent the lapping of straps round shafts.
892. William Hadfield, Manchester—Certain improvements in looms for weaving.
894. John Barnett, 134 Minories—Improvements in smiths' hearths.—(Communication from Jean A. Petry, Liège.)
895. William P. Sharp and William Wield, Manchester—Improvements in the manufacture, and in machinery for the manufacture of spun or thrown silk threads.
896. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the consumption or prevention of smoke.—(Communication from Réné Garcon, Paris.)
897. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for spinning cotton and other fibrous materials.—(Communication from Messrs. Constant, Pengeot, & Co., Andincourt, France.)
898. William Winter, Carlton-hill, Nottinghamshire—Certain improvements in the manufacture of warp-looped fabrics.
899. William A. Edwards, 87 Brook-street, Lambeth—Invention for separating certain metals from metallic substances.
900. William C. T. Schaeffer, Bradford—Improvements in the treatment of the waste wash waters of wool and other mills.
901. Samuel Walsh and John Brierly, Halifax, and 25 Noble-street, Cheapside—Clasp or fastener for belts, bands, or straps.

Recorded April 23.

903. Joseph Whitworth, Manchester—Improvements in ordnance fire-arms, projectiles, and machinery for the manufacture thereof.
905. John Orr and James Templeton, Glasgow—Improvements in the manufacture of figured fabrics.
907. Alfred V. Newton, 66 Chancery-lane—Improved machinery for separating substances of different specific gravity.—(Communication.)

Recorded April 24.

910. Joseph Taylor, King-street, Westminster—Improvements in propelling vessels.
911. William W. Richards, Birmingham—Improvement or improvements in repeating or revolving fire-arms.
912. Josiah Horsfall, Manchester—Machinery for mitreing moulded and other sashes.
913. James and George Hunter, Leysmill, Forfarshire—Improvements in stone-cutting machinery.
914. Francis M'Kenna, Salford—Certain improvements in power looms for weaving.
915. Frederick J. Utting, Wisbeach, Cambridgeshire—Improvements in land rollers and clod crushers
916. Matthew A. Muir, Glasgow—Improvements in the manufacture or moulding of railway chairs.
917. Chares P. Smyth, Edinburgh—Improvements in astronomical and geodetical instruments.
918. Charles Jordan, Newport—Improvement in discharging cannon.

Recorded April 25.

921. Louis A. Avisse, Paris—Improvements in lubricating revolving shafts of all descriptions, and also the axles of railway and other wheels.
923. James Wallace, jun., Glasgow—Improvements in bleaching, washing, or cleansing textile fabrics or materials.
924. Mark Mason, Dukinfield, Cheshire—Improved machinery or apparatus for manufacturing metallic "sole-tips" and "heels" for clogs, boots, or other coverings for the feet.
925. John J. Victory, Henrietta-street—Certain apparatus for marking out curved lines upon wood and stone, specially adapted to the marking out of hand railings, together with improved machinery for boring and sawing wood.
926. John Black, Hampstead-road—Improvements in axles, shafts, and bearings.
927. John Hunter, Liverpool—Improvements in the distillation of turpentine and other resinous substances.—(Communication.)
928. Auguste E. L. Bellford, 32 Essex-street, Strand—New and improved machine for planing screw-nuts and bars of any prismatic form.—(Communication.)
929. Auguste E. L. Bellford, 32 Essex-street, Strand—Improved gas regulator.—(Communication.)
930. Auguste E. L. Bellford, 32 Essex-Street, Strand—Improvements in the manufacture of seamless garments, or other useful articles of felt.—(Communication.)
931. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in scales or machines for weighing.—(Communication.)
932. John B. Wilkin, Helston, Cornwall—Improvements in stamping and dressing or separating ores of any kind, but more especially tin ones.
933. Auguste E. L. Bellford, 32 Essex-street, Strand—Improved chaff-cutting machine.—(Communication.)
934. Auguste E. L. Bellford, 32 Essex-street, Strand—New and improved lock for sliding doors.—(Communication)
936. Samuel Draper, Lenton, near Nottingham—Improvements in apparatus for retarding and stopping railway trains.
937. Julius Jeffreys, Kingston-hill—Improvements in engines or machines for raising, diffusing, or injecting fluids.
938. Edward Frankland, Manchester—Improvements in the treatment of certain salts, commonly called alums, to obtain products therefrom.
939. George A. Huddart, Brynkir, Carnarvonshire—Improved machinery for obtaining motive power from running waters.
940. Joseph Peabody, Old Broad-street—An improved construction of haymaking machine.—(Communication.)
941. John Silvester, Smethwick, Staffordshire—Improvements in spring balances, and in their connection and adjustment to steam valves.
942. George A. Huddart, Brynkir, Carnarvonshire—Improved machinery for obtaining and applying motive power.

Recorded April 26.

943. John Elce and John Bond, Manchester—Improvements in caseing, guarding, and protecting revolving shafts and mill work in general.
944. Peter Armand le Comte de Fontaine Moreau, Paris, and 4 South-street, Finsbury—Improvements in apparatus for preventing the escape of fluids, which he calls diaphragm obturator.—(Communication.)
945. Auguste E. L. Bellford, 32 Essex-street, Strand—Invention of a new combination of slide valves and ports for the induction and eduction of steam or other elastic fluid in steam engines, or other engines of similar character.—(Communication.)
946. William Sheers, Bankside, Southwark—An improvement in cases or magazines for gunpowder or other explosive preparations or compounds.
947. Thomas H. Burley, Ohio, U.S.—Invention of a new and useful machine for making dovetails.

Recorded April 27.

948. Robert P. Coignet, Paris, and 4 South-street, Finsbury—Certain improvements for rendering tissues waterproof.
949. Peter Armand le Comte de Fontaine Moreau, Paris, and 4 South-street, Finsbury—Invention for the application of certain primitive products to the manufacture of bearings, and all parts of apparatus subjected to friction.—(Communication.)
950. Alfred Crosskill, Beverley, Yorkshire—Improvements in machinery for turning and spreading cut grasses or hay.
951. Thomas Page, Middle Scotland Yard—Improvements in ordnance.
953. Jean C. G. Massiquot, Paris, and 32 Essex-street, Strand—Certain improvements in lithographic presses, and inking apparatus connected therewith.
955. Henry Collett, 12 Grosvenor-street, St. Peter's-street, Islington—Improvements in pumps or machinery for raising water or other fluids.
956. Edward Myers and John W. Potter, Rotherham—Improvements in stoves for warming apartments.
957. Richard Clark, Strand, and John T. Stroud, Birmingham—Certain improvements in lighting, applicable to table, street, signal, and other lamps, as also for the constructing, denoting, and regulating the signals and burners of lighthouses.

Recorded April 28.

958. Thomas Knowles and James Knowles, Manchester—Improvements in steps and bolsters to be used in machinery for spinning, doubling, winding, and similar processes.
959. Daniel Warren, Exmouth—Certain improvements in obtaining and applying motive power.
960. Frank J. W. Packman, Puckeridge, Herts—Improvements in projectiles in projectile instruments, and in the means of charging the same.
961. Alfred V. Newton, 66 Chancery-lane—An improvement in file-cutting machinery.—(Communication.)
962. William E. Carrett, Leeds—Improvements in motive power engines.
963. James Marsh, 13 Store-street, Bedford-square—Improvements in the construction of pianofortes for rendering them more portable.

Recorded April 30.

965. Edward Acres, Pouldrew Mills, Waterford—Improvements in desiccating and cooling atmospheric air, and the application thereof to useful purposes.
967. William Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in regulating the pressure or flow of gas or fluid bodies.—(Communication from Samuel W. Brown, Lowell, Massachusetts, U.S.)
969. Henry Francis, 456 West Strand—Improvements in manufacturing boots and shoes.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

DESIGNS FOR ARTICLES OF UTILITY.

Registered from April 4 to April 20.

April 4th,	3701	B. Wheeler, Nottingham,—" Fire-brick."
5th,	3702	F. De la Rue & Co., Bunhill-row,—" Fastenings for portfolios."
—	3703	Foster, Porter, & Co., Wood-street,—" Alliance shawl."
7th,	3704	N. Greig, R. Taylor, & J. Chandler, Bermondsey,—" Can-jar or case."
10th,	3705	N. Brough, Birmingham,—" Clasp or buckle."
11th,	3706	T. F. Hale, Bristol,—" Sling-action beer-engine."
18th,	3707	A. Emett, Liverpool,—" Chimney-top."
—	3708	Knight, Merry, and Exley, Birmingham,—" Cooking-lamp."
20th,	3709	E. B. B. Wren, Tottenham-court-road,—" Camp arm-chair."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered.

March 30th,	649	W. A. Morrison, Middlesex,—" Breech-loading ordnance."
31st,	650	J. Hinks, Brompton,—" Protector for rolled ribbons."
April 11th,	651	C. Wills, Winchester,—" Union railway chair."
—	652	T. Bullock, Chelsea,—" Lever tap."
12th,	653	J. F. Fenner and T. H. Hidey, Gray's-inn-road,—" Tobacco-pipe."
—	654	G. Grout, Tottenham,—" Crotchet cotton armlet."
17th,	655	J. Cooke, Colchester,—" Portable poultry pen."
18th,	656	J. S. De Pinna, Regent's-park,—" Artificial grape."

TO READERS AND CORRESPONDENTS.

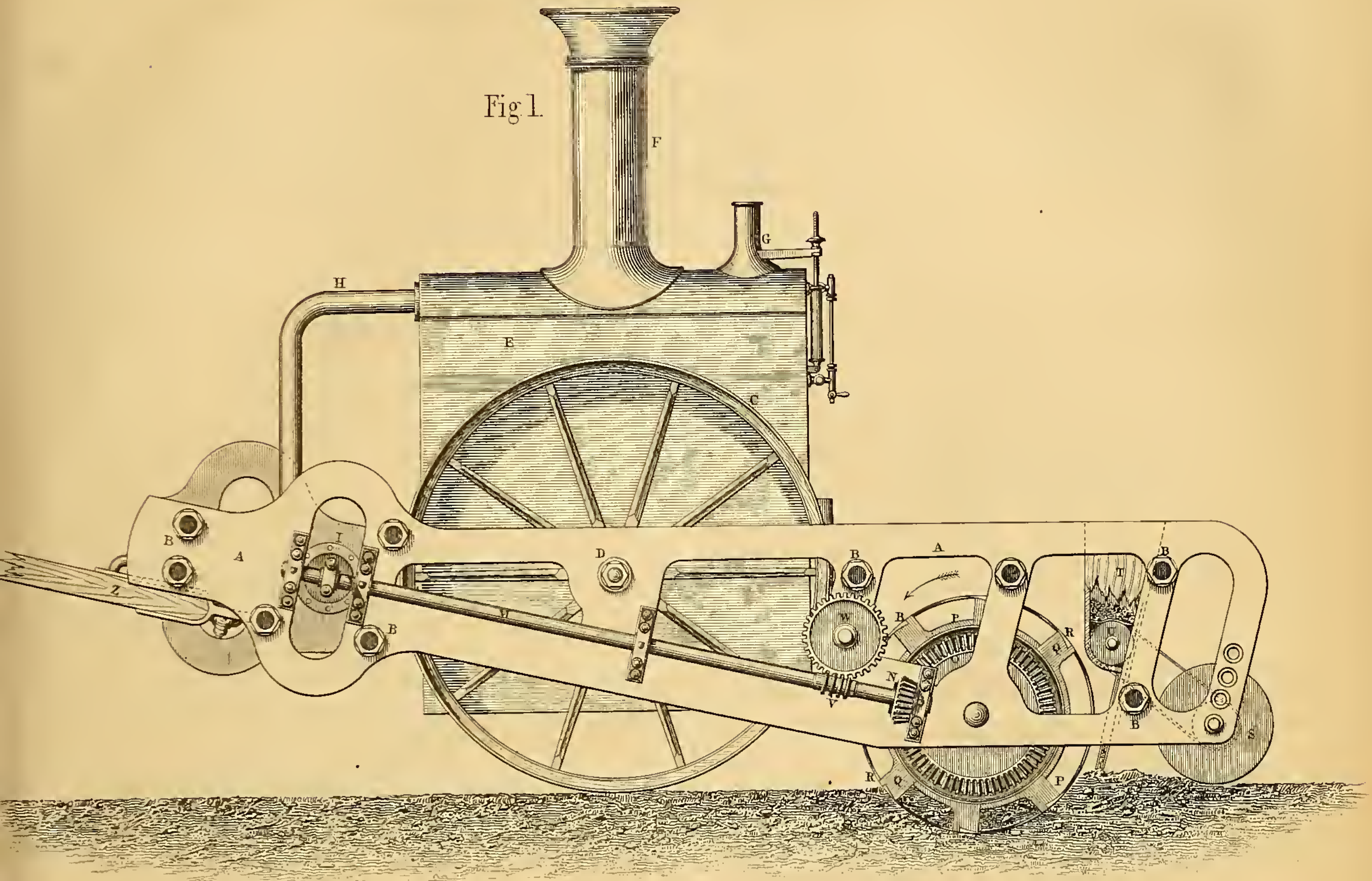
The Screw-Propeller in Large Sailing Ships.—In our report of the discussion on this subject at the Institution of Civil Engineers, as given by us at page 37, last month, we have inadvertently given Mr. Allen's name as that of the author. The author, as will be evident from our previous notice, is Mr. R. A. Robinson.

An Amateur.—He will find the mode of painting magic lantern slides fully described in many works—the "Boy's Own Book," for instance. Nearly every mechanics' institute possesses books which will give the fullest information on such particulars.

COMBINED HORSE & STEAM CULTIVATOR,

R. ROMAINE, PATENTEE.

Fig. 1.



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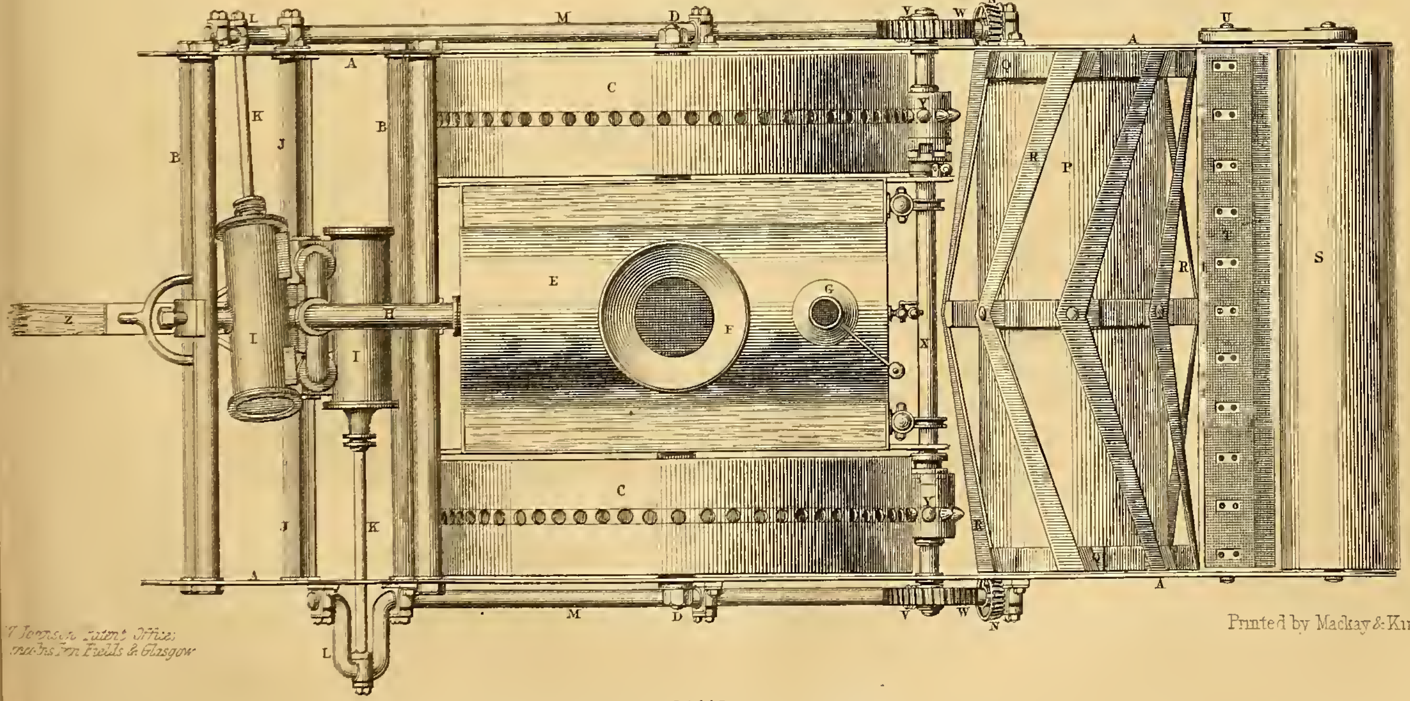

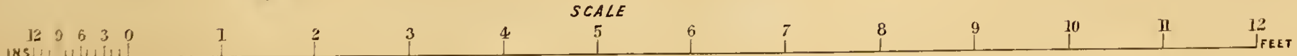

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MECHANICAL ADAPTATIONS OF INDIA RUBBER SPRINGS,

W. C. FULLER PATENTEE.

2 BUCKLERSBURY, CHEAPSIDE, LONDON.

Fig. 1.

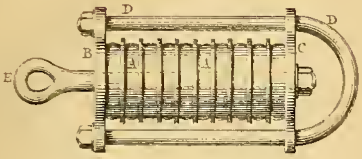
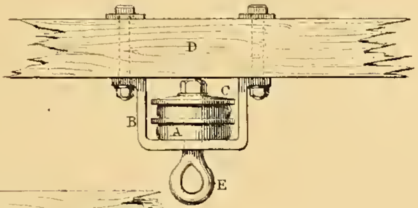


Fig. 2.



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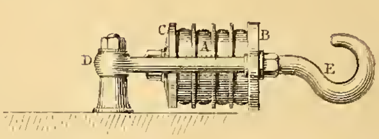

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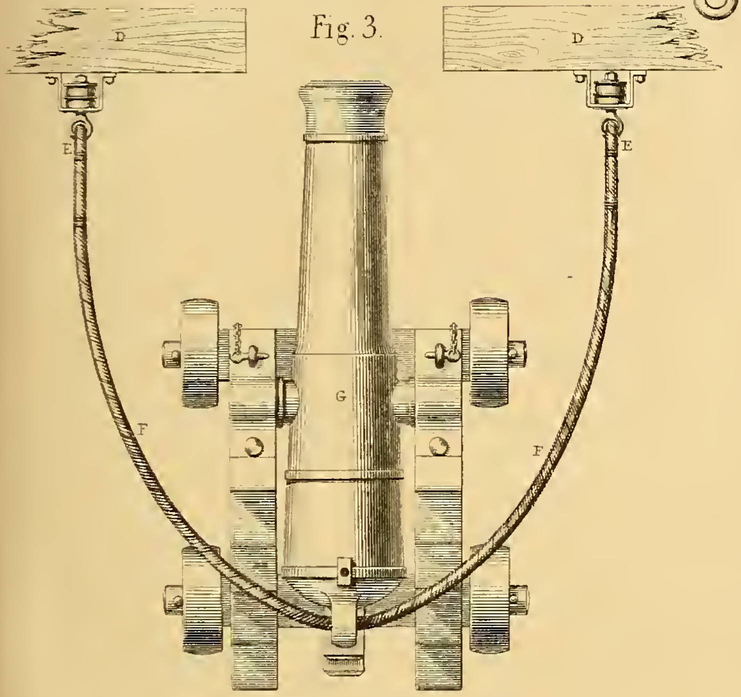

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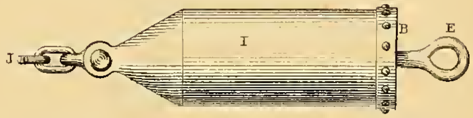


Fig. 6.

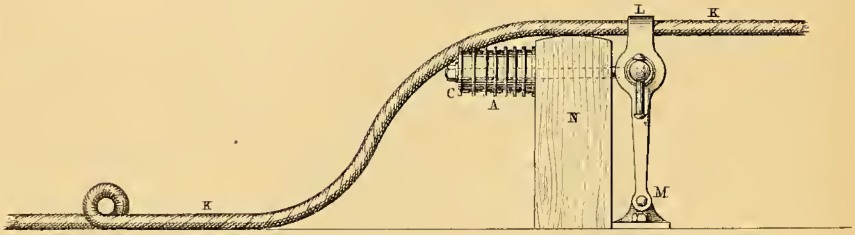


Fig. 7.

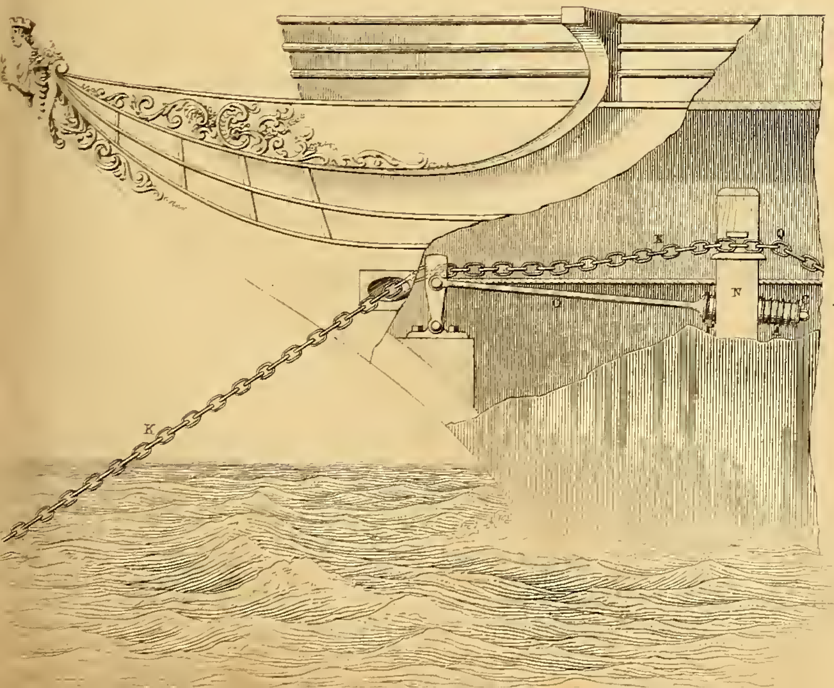
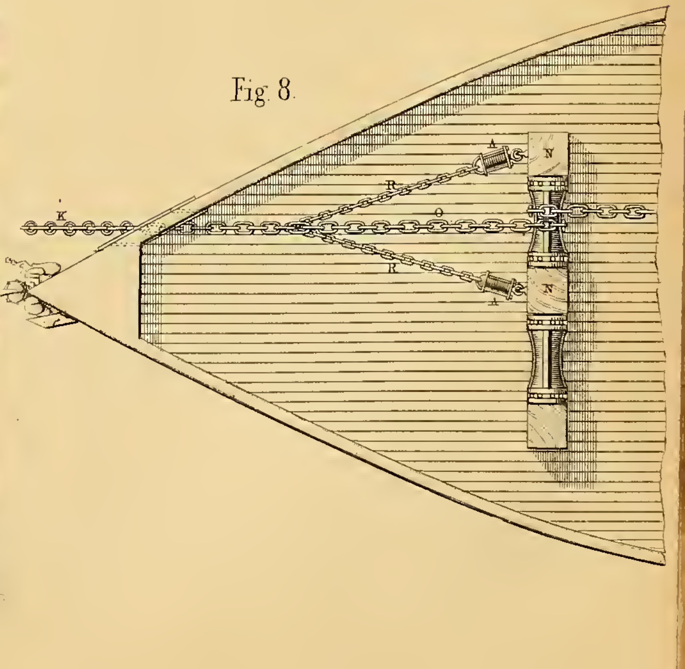
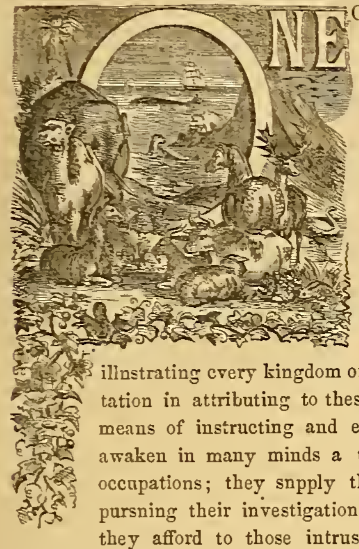


Fig. 8.



COMMERCIAL PRODUCTS OF THE ANIMAL KINGDOM IN THE TRADE MUSEUM, LONDON.



ONE OF the characteristics of the present time is the taste for forming and visiting collections of interesting objects. This taste has been shown, not only at various Great Exhibitions in metropolitan cities, but in local museums scattered through the towns of the empire. Such museums usually consist of a miscellaneous collection of objects, brought from every quarter of the globe, and illustrating every kingdom of nature. There can be no hesitation in attributing to these collections a high value, as a means of instructing and enlightening the people. They awaken in many minds a taste for refined and elevating occupations; they supply the educated with the means of pursuing their investigations in the domain of nature; and they afford to those intrusted with the task of education texts and illustrations, which they could not easily procure elsewhere. Besides the collections of the class we have mentioned, there are others, composed of objects belonging to special sections of knowledge, or to particular departments of nature. For an example of these, we may refer to the collection of anatomical and physiological objects at the College of Surgeons, London. There is, also, a third class of collections, intended to bring together objects only so far as they have been found useful to man, and have given rise to manufactures, trade, and commerce. Such is the museum at Kew; where it is intended to show every kind of vegetable product which has, in any way, been usefully adapted to the satisfaction of the wants of man. Another example is the Museum of Economic Geology in London, where may be seen illustrations of our manufactures in metal, pottery, glass, &c., together with specimens of the mineral substances of Great Britain which have been found susceptible of useful application. At the rooms of the Society of Arts, there is now exhibiting a large selection of samples of *animal* produce and manufactures, and it is of this that we now propose to say a few words. This collection is the commencement of a Trade Museum, designed to illustrate the productions, industrial resources, manufactures, and commerce, not only of our own country, but of the whole world. The present exhibition, however, is limited to animal products, and is but a very imperfect specimen of what it can and ought to be. When we say this, we have no intention of censuring the collectors, contributors, or curators. It is but a beginning—a short time only was given to the collection of the contents—and hence it is very small in comparison with what it will be hereafter. It is, however, highly interesting, and well deserves a visit. Its arrangement has been made by Professor Solly, who has adopted a technical division, for the convenience of classification. It is much to be regretted that the room where the objects are deposited, is not only too small for the purpose, but is very ill lighted.

First, we have the Wool Series of objects, then the Silk Series, followed by the Skin Series, the Horn and Bone Series, the Fur Series, the Bristle Series, the Feather Series, the Horsehair Series, the Lac Series, the Wax Series, the Oil Series, the Shell Series, and, lastly, a number of articles falling under the head of Refuse Matters.

In the Wool Series may be seen specimens of fleeces, and samples of wool, not only from Britain, but from foreign countries; illustrations of the manufacture of wool, and specimens of cloth from the coarsest quality to the finest broad cloth. Messrs. Salt & Son, of Saltaire, have sent samples of brown, black, grey, and white alpaca wool, and specimens of the manufactured article. They have also sent samples of mohair or goats' wool, and of the fabric made of it. There is a large collection of shoddies, of carpets, moreens, &c., and amongst the minor articles in this division, we noticed samples of woollen paper, and of flock paper for the walls of rooms. In this article the figures are raised and made of flock.

Turning to the Silk Series, there is exhibited a large collection of cocoons, some white, some yellow, some buff, according to the variety of worm producing them. Also specimens of the moths, and of their congeners. One gaily-coloured moth measures 9$\frac{3}{8}$ inches from tip to tip of the wings, and 4$\frac{1}{4}$ inches from the head to the extremity of the wings. Another moth of smaller dimensions is coloured green, and its wings terminate in long tails. The cocoons formed by the worm have a metallic lustre, and look as if made of fine wire. The moth producing the worm which spins the ordinary silk of commerce is much smaller than either of these. There is shown a single cocoon, which has been opened out so as to form a kind of bag of large size, and so thin as to be quite transparent. In this state cocoons are used in China for the wadding of dresses. Another curious object is a framed landscape, woven on white silk with black thread. This came from Potsdam near Berlin, and is very neatly executed. In this series are found samples of raw silk from every quarter of the world; specimens of woven silks, watered, gros de Naples, &c.; and illustrations of weaving and dyeing.

In the Skin Series, we find such raw skins as are usually turned some way or other to account, and specimens of skins which do not often meet the public eye, except as part of a living animal. For instance, here is part of a tanned walrus' hide two inches thick. This is largely used in the polishing and finishing of cutlery. There are also portions of the skins of a rhinoceros and a hippopotamus. The former took eleven years to tan thoroughly. Here are seen specimens of substances used in tanning, from the well-known oak bark to such articles as valonia from Smyrna, cutch from Pegu, divi-divi from Maracaibo, myrobolans from Bombay, mimosa bark from Australia, shumac leaf and ground from Sicily. Also tools employed by tanners, leather-dressers, curriers, bookbinders, saddlers, and other artisans in leather. There is a pretty illustration of the glover's art, consisting of a goat's skin, on part of which the hair is still remaining, whilst other portions show the skin at different stages of preparation for the glover. Then we see the glove cut out ready for sewing, and, finally, a glove sewn as far as it can be without detaching it from the skin. In this series has been placed specimens of goldbeaters' skin. One case contains illustrations of goldbeating, sent by Mr. Rieger, 3 Tabernacle Square, Finsbury. First, the model of a small ingot is shown, the gold being usually 23 carats fine. It may be as well to remark, that perfectly pure gold is considered to be 24 carats fine, whilst the gold of our coinage is 22 carats fine; that is to say, 2 parts in 24 consist of alloy. In the manufacture of gold leaf, an ingot, of say 2$\frac{1}{2}$ oz., is cast with a width of 1$\frac{1}{8}$ inch, and is then rolled by machinery into the length of six yards. This is divided into 171 or 172 pieces, each one of which is placed between vellum, and beaten by hammers upon blocks of marble supported by wood. When the piece has been beaten out of a certain size, it is again divided, and the beating out and subdivision go on until the requisite degree of thinness has been obtained; in the latter part of the process, what is known as goldbeaters' skin being employed. The leaf as used by bookbinders is in squares varying from 3 inches to 3$\frac{3}{8}$ inches, and is sold in little books containing 25 leaves for fifteen pence. There is a good deal of waste in the process of manufacture, for the ragged edges of the leaves must be cut off from time to time, and the result is, that out of an ingot of 2$\frac{1}{2}$ oz. only 17 or 18 pennyweights appear as gold leaf; the rest goes back into the melting pot in the shape of fragments. It is not only the bookbinder who makes use of gold leaf; it is also largely employed by dentists in filling the cavities of decayed teeth; but when so employed, the beating has not been prolonged so long as to reach the extreme degree of tenuity. It is well known that light passes through gold leaf, and it is curious, that if alloyed with silver the light transmitted is blue, whilst if copper has been employed the light is green. We may remark that the skin, which authorizes the introduction of an illustration of goldbeating into the Museum, is composed of ox gut stretched into sheets, and rendered very smooth by peculiar processes. After the skin has served the process of the goldbeater, it is sent to Germany, where it is employed in the beating of the alloy called Dutch metal.

In the Horn and Bone Series have been collected the horns of the ox, buffalo, deer, &c., elephant's and narwhal's tusks, tortoise shells, &c., with a variety of useful and ornamental articles made from them. Some of the ivory articles are very beautiful, taking the forms of pagodas, chandeliers, &c. Here is an entire tortoise shell polished; also a number of manufactured articles in bone.

In the Feather Series, we have not only samples of feathers used in upholstery, but of writing quills, artificial flies used by the angler, and feather flowers, some of the latter having travelled from Madeira.

The Wax Series contains specimens of bees and their combs; rough and purified wax from different countries; wax flowers and wax candles, with illustrations of the manufacture of the last. Here also are seen samples of pe-la, the beautiful white wax of China, formed on trees by an insect, the *Coccus sinensis*, with specimens of the insect itself, and the secretion as deposited on the branch.

The Museum contains samples of many kinds of animal oil, whale, sperm, seal, &c., with illustrations of their purification, and the manufacture of soap, candles, and stearine.

In the Shell Series, we find specimens of the shells used for cameos. Also mother-of-pearl shells, some in their rough state, others decorticated and polished, or cut into pieces and ground. Buttons, knife-handles, and inlaid work, wood, or papier-maché, show the uses to which mother-of-pearl are applied. White mother-of-pearl is obtained from the shell known to naturalists as *Meleagrina margaritifera;* green mother-of-pearl is extracted from a shell found at New Zealand, called *Haliotis splendens.* But several other shells furnish mother-of-pearl of more or less value.

Under the head of Refuse Matters are samples of manures, and illustrations of the manufacture of ammonia, prussiate of potash, phosphorus, &c. There is a large mass of crystallized prussiate of potash of a rich yellow colour, sent from the Hurlet Alum Works, Glasgow. This salt is procured by burning together refuse horn, or feathers and potash. The compound called metal looks like a black cinder. It is then treated with water, which dissolves the salt, and the latter is obtained by dissipating the water. Prussic acid and prussian blue are obtained from the salt.

Amongst the miscellaneous articles are samples of two kinds of cochineal, black and silver, from Mexico, the West Indies, Teneriffe, and other places, with specimens of carmine, obtained from the dried insect. Also gut in various shapes, from bands for driving lathes to fiddle strings.

Altogether this collection, the nucleus of a great Trade Museum, is highly interesting, and deserves more attention than appears to be paid to it.

STEAM-PLOUGH CULTIVATION: ROMAINE'S COMBINED HORSE AND STEAM CULTIVATOR.

By Mr. R. Romaine, Peterborough, Canada West.

(Illustrated by Plate 172.)

Numerous as have been the attempts made, of late years, to aid the farmer in his agricultural operations, and ingenious as many of the inventions undoubtedly are, the tiller of the ground is still far from possessing all the assistance which science is capable of affording him. Two considerations will, in a great measure, account for this state of things—the difficulties arising from the extent of space over which the machinery is required to act, and then the want of a knowledge of mechanics amongst practical agriculturalists, or of an ignorance on the part of mechanicians of the precise requirements of the agriculturalist. These are the times, no one can doubt, when cheap food is more required to be produced than ever it was, for reasons connected, not only with the welfare of the consuming part of the community, but of the producing part also. Larger demands are consequently made every year upon inventors and machinists to supply the means of abridging the labours of muscle and sinew, and of doing that quickly which has hitherto been done slowly. In our uncertain climate, the occurrence of a few days of bad weather at a critical time, frequently operates most prejudicially upon the work or crop in hand; but if the farmer could get through that work, or gather in that crop, in a shorter time than at present, his loss might be altogether avoided. It is, of course, an important point to reduce the cost of production by a saving in the expense of labour, both in operations relating to the actual cultivation of the soil, and in those which deal with the crop in order to render it fit for use or market. If it has hitherto been found impossible to apply the steam carriage to common roads with any beneficial effect, in consequence of the inequalities of the road, and of the want of a sufficient resistance in it to the pressure of the carriage, how greatly are the difficulties multiplied when the carriage is required to traverse a soft field! Hence, in this portion of the farmer's labours, little, comparatively, has been done to shorten or facilitate them. On the other hand, in the operations of thrashing, dressing, chopping hay, straw, and green food, and pumping, the farmer has derived important assistance from the steam-engine.

Amongst the more recent of the inventions which the mechanical man has given to the farmer, are some importations from the far-off Canada West. These inventions, which have been secured in this country, under two separate patents, by Mr. J. H. Johnson, on behalf of the inventor, Mr. Romaine of Peterborough, Canada West, deserve to be recorded in our pages as the most successful of modern applications of mechanism to the purposes of the field. By a judicious combination of lightness, strength, and the power of traversing the earth with facility, Mr. Romaine has earned a success which time, we think, will but more fully develop.

Fig. 1 on our plate is a side elevation of Mr. Romaine's machine, representing it as with its digging cylinder in its working position, and fig. 2 is a plan corresponding to fig. 1. The steam-boiler, engines, and working details, are all carried on a light carriage framing, composed of two parallel vertical side plates, A, of thin plate-iron, connected together by tubular stays, B, and carried upon a pair of broad-flanged wheels, C. These wheels run loose upon stud-pins, D, bolted to the frame-plates, A, and their breadth of flange enables them to support the weight of the apparatus without sinking too deeply into the ground. The steam-boiler, E, which is carried in the mid space between the two wheels, C, is of a rectangular form, with a slightly curved top. It is furnished with an internal furnace, and with tubular water spaces, which are arranged so as to envelop the fire as much as possible, the furnace gases and smoke passing off by the chimney, F. A safety-valve, G, is fitted upon the back end of the boiler, and the steam passes to the engines by the pipe, H, issuing at the front end. The engines consist of two small oscillating cylinders, I, disposed transversely, one before the other, in the centre between the frame-plates, A, and in front of the boiler. These cylinders oscillate on central trunnions, and are supplied with steam by the simplest possible kind of valves. Each cylinder is formed with a planed port face near each end, upon which faces are the open ends of the ports leading to either end of the cylinder. These port faces work up against planed surfaces upon a transverse frame-piece, J, situated between the two cylinders, and upon these surfaces open passages communicating with the steam-pipe, H, and with the exhaust pipe. The oscillation of each cylinder causes it to bring its ports alternately opposite to the steam and exhaust passage in the valve faces on the frame-piece, J, and by these means the usual expensive valve gearing is dispensed with, and the engine is rendered simple, and not liable to get soon out of order. The trunnions of the cylinders are solid, and work on screw-pins as centres, and, by screwing up the two outer pins, the valve faces may be kept in close contact. The exhaust pipe is not seen in the engravings, but passes away directly below the steam-pipe, H, from the under side of the frame-piece, J. It may be carried to the chimney, F, so as to assist the draught, like the locomotive blast-pipe; or it may be contrived so that the waste steam shall give off its heat to the feed-water. The feed-water is contained in two compartments, one on each side of the boiler, as seen in the plan, fig. 2. The piston-rods, K, of the steam cylinders pass out in opposite directions, and working through elongated openings in the frame-plates, A, are jointed respectively to cranks, L, on the upper ends of two inclined shafts, M, carried in bearings on the outsides of the frame-plates, A. These shafts pass to the back of the machine, and have bevil wheels, N, fixed on their lower ends. The bevil wheels, N, gear with bevil wheels, O, fast on the opposite ends of the spindle of the digger cylinder, P. The cylinder, P, is arranged horizontally and transversely, and its spindle revolves in bearings in the frame-plates, A. The bevil wheels, O, are entirely within the ends of the cylinder, so that they cannot become clogged by the earth disturbed by the cylinder. The cylinder has fixed upon its periphery three sets of short radial arms, Q, upon the outer ends of which are fixed a series of double-inclined edged blades, R. These blades constitute the cutters or digging details which act upon the ground. The cylinder rotates, at a considerable velocity, in the direction of the arrow, and as the machine slowly traverses in the same direction, the earth is thoroughly reduced, broken up, and disintegrated to the depth to which the blades, R, reach. This depth is regulated by means of the back supporting roller, S, which is carried in bearings in the extreme ends of the frame-plates, A, a series of bearings being formed in the frame-plates, one above the other, so that the roller, S, may be adjusted in one or other pair, according to the depth to which it is wanted to act upon the ground. The roller, S, also acts as a weight to keep the cylinder, P, down to its work, and, when it is desired to make it act to an increased depth, a heavier roller may be put on. A platform (not represented in the engravings) is fixed across the top of the frame-plates behind the boiler, and upon this platform the fuel is put, and also additional weights, if necessary. A seed box, T, is fitted up between the cylinder, P, and the roller, S, and the machine is capable of preparing the ground and depositing the seed at one operation. The deposition of the seed through suitable ducts is regulated by a grooved roller, U, driven by a belt and pulleys off the roller, S. The machine may either be traversed over the ground by means of horse power, or it may be arranged to propel itself. For this latter purpose, the shafts, M, have a worm, V, formed upon each of them, these worms being in gear with worm wheels, W, fast on a transverse shaft, X, which carries two pinions, Y. These pinions are formed with pointed teeth, which gear into holes formed round the peripheries of the wheels, C, and these last are thereby caused to rotate and to traverse the machine slowly over the ground. The pinions, Y, are loose upon the shaft, X, and are put into gear by means of clutch-boxes, so arranged that only one of the wheels may be put into gear when it is wished to turn the machine, by which arrangement the machine is enabled to turn in a very small space. The shaft, X, also carries small eccentrics for working the feed-pumps, which are represented as disposed vertically at the back ends of the feed-water spaces. The pole, Z, for attaching the horses, is connected to the tubular stays, B, at the front of the machine.

The patentee states that this machine will do the work heretofore performed by the plough, subsoil plough, harrow, and sowing machine at one operation, and in much less time than is occupied at present. The fine pulverized condition into which it reduces the earth, admits of the latter being levelled down or put into drills for sowing. To accomplish this, either a plain or a serrated levelling board is fitted behind the rotatory cylinder, and, when furrows are required, a mould-board is fitted up at either side for that purpose.

The performances of the original modification of this machine at the Tiptree Hall farm of Mr. Mechi, will still be fresh in the recollection of our readers. The form into which it has now grown, presents many features of improvement upon that arrangement. One of the machines is now in the French Exhibition, and others are being constructed in this country, several eminent agriculturalists having resolved upon adopting it, if its trials under their auspices should be as fair as they have now good reason to hope.

THE MODERN ART OF SUN-PAINTING.

This wonder-working time—the central portion of the nineteenth century—has given us no greater useful curiosity than the art of photography. What were once simply discolorations due to the objectionable effect of light, when grasped by the bold hand of science, have conducted us into full possession of one of the highest of conceivable enjoyments, that of obtaining representations of whatever is loveliest in nature or art, whatever holds within it associations which we wish to retain undimmed, or, chief of all, whatever, being evanescent in itself, deserves to be caught up and embalmed more securely than lies within the limits of memory's unenduring powers. It is hardly possible to imagine anything which could have so heightened the pleasures of existence as this modern invention, this employment of the light of heaven in limning all which we would willingly see stored up for us in the portfolios, or displayed upon our walls. Under its reign, no passing pageant need lack its painter. Scenes, which alone form pages of the world's history, may now be transmitted down in all the realities of actual existence, independent, as well of the imaginative brush of the painter, as the prejudiced or falsely informed pen of the historian. We read written history, not to tell us of what positively occurred in days now lost in the twilight of fable, but to give us the peculiar views and imperfect constructions of artificial storytellers. But the truth-telling sun is open to no such difficulties; if it does not embellish plainness, at the least it does not touch the perfection of facts. How many now disputed points would not a camera have served to clear up; and how many historical links, now for ever lost to the world, would it not have preserved to us for the calm and truthful consideration of succeeding times?

There seems to be but one important element wanting to the full success of the art of sun-painting, and that is the reproduction of the natural colours along with the outline and the mere light and shade. We have had many false alarms of schemes to accomplish this great end, and many of the developed tints do approach so near to nature as to buoy up our hopes of an early success in copying colours without the aid of the artist's hand. But there are other hues, and those the most marked and brilliant of the range, which seem to defy us, and we must look to far other means than any of which we have so far availed ourselves, if we seriously set about attaining this object. Until this desirable point is reached, the art, for very many purposes, must remain as an assistant to the painter, or rather the colourist. In portraiture works the natural photograph finds its own light and shade; but for warmth and brilliancy of colouring after nature, it must come to the painter, otherwise we have but the ghastly tints of the earlier daguerreotypes. The same dependence occurs throughout all classes of pictures, and whilst we must admire the elaborate finish of the camera's pictures, in all the details of outline and general effect, we cannot but regret the absence of that richness and fullness of beauty which colour alone can give. But apart from the many advantages which the art confers upon us, were it only for the perfection of its accuracy of outline and relative position of the delineated objects, the pursuit of the photographer would be well worthy of all the admiration we can bestow. It gives us the reality of perspective, the accurate proportion of objects, and answers as a trustworthy master in outline, for it cannot deviate from the very essence of truth. But there is, in many instances where the brush is used, too great a tendency to overpower the original picture with colour. Colour must be most sparingly used or not at all, and no worse compliment can be paid to the art than to say, that a coloured specimen of it rivals a good miniature. In the best miniatures, the hand of the artist and the striations of his brush are plainly visible, giving a roughness and unfinished effect to the picture. But no one can say this of a really fine photograph, where no hand and no brush appear. The semblance does indeed mock the original, and confesses to no means of production. The careful and restrained touches of the brush, then, in no way impair the fineness of the original drawing, whilst they afford a life-like effect which nature herself cannot produce.

In this practical age, we must turn our attention to the employment of the photographer for purposes of a more utilitarian class than those with which we usually associate his labours. Portrait taking was the most obvious class of work to which he should first address himself. The universal scope of this practice naturally led to the rapid development of the art, and induced the successful working out of many details which have conduced, in a remarkable degree, to the sound progress of this system of imagery. By this agency has it been perfected sufficiently to carry it into other and more elevated fields, and we have now arrived at the time when this substantial development becomes almost daily more and more apparent. In Messrs. Hoopers' plan of securing accurate pictures of their carriages, as discovered by us last month, we have unearthed one of the latest steps in the direction to which we have so often pointed. This is an application for which the art is especially suited, inasmuch as its power of elaborating the most minute details here finds a field well worthy of it.

The constructive engineer has long since adopted the process, both for the representation of his finished productions, and for furnishing pictures of the progress of his larger out of door works. Instead of writing out a long inexplicable story of what has been done, the superintending head periodically takes a photograph of his men's performance and transmits it to his chief. Such a picture shows how the undertaking looks on the ground, and conveys information which all the letters that could be written would fail to explain. The realities of effect can thus be shown, with the view, not only of indicating what has been done, but also of giving the opportunity of remedying a mistake before it is too late, or of remodelling the design wherever defects become prematurely apparent. A legal question, just now before the House of Lords, has afforded an opportunity of testing the merits of this application for a purpose of like import. In the example to which we refer, it has been proposed to execute some large pictures of the great harbour shed recently erected on the banks of the Clyde at Glasgow, the object being the representation of the grievances of a neighbouring proprietor, whose interests are alleged to have suffered detriment from the structure in question. The pictures will, of course, convey accurate evidence of the real state of matters between the disputants, and thus convince the great supreme tribunal by an argument which is at once dispassionate and clear.

The commercial traveller, too, has found it to be to his advantage to enrol the photographic art amongst his business agents. In the old days of stage coaches and gigs, the business traveller used to be hampered with tons of samples of his wares, and even now, with all the refinements of practice which time has brought us, he is still encumbered with a far too weighty responsibility in this way. To get rid of this difficulty, which, in no small degree, clogs the path of commercial negotiation, Mr. J. G. Taylor of Edinburgh calls the photographer to his aid. Instead of tons of jewellery and trinkets, he now takes a few pounds weight of photographs, and thus shows off his wares with effect, without taking a single original with him. To avoid the uncertainty which would arise from photographing burnished and glittering articles, he takes his pictures whilst the goods are yet in the rough. Or, he coats them with such a wash as shall remove the defect due to the too great play of light, whilst it does not impair the outline of the image. The enterprising shopkeeper who wishes to exhibit the vast extent and business-like appearance of his repository to an admiring circle of customers, is another customer to the photographer. The camera gives him an unapproachable picture of his premises, which he can either reduplicate by photographic printing-frame negatives, or hand over to the wood engraver for multiplication to a still larger extent.

But the members of young America step ahead even of these examples of applied sun-painting. The Yankee man of fashion, it is said, does not descend to the prosaic plan of engraving his name on his visiting cards, but fills his card-case with photographs of himself, which he hands instead. The idea is novel; but our means of recollection on this side of the Atlantic would hardly suffice to enable us to bring to mind the person and position of the visitor from a casual inspection of his picture.

The history of all improvements tells us that no innovation can be effected without some interference with the legitimate province of established practitioners. The self-acting mule displaced multitudes of discontented spinners; but it found a large increase of fairly paid labour for other classes of industrialists. "It is an ill wind that blows nobody good;" and it is the lot of but few inventions to do nobody any harm. Thus, the miniature painters, and even the larger class of portrait painters, must have felt with some severity the advent of the upstart photographer. When people could obtain a marvellously well-finished miniature for a few shillings, it was too much to expect them to give the miniature artist his former expensive commissions. But even now the photographer essays to rival the labours of even the historical artist. In his new vocation of composing pictures, the photographer fits up his studio with backgrounds, mainly composed of real articles, and he then forms the necessary groups of male and female figures, appropriately dressed, to tell the tale of his intended picture. This stands as the material of his picture. It is indeed his living picture, which has only to be transferred to the field of the camera to become a transferable composition. Some excellent results have lately been achieved in this way, the pictures having all the effect which is due to a close copying from nature. This system of picture-making is obviously of very wide application. The work of the artist is concentrated upon the choice of details and the grouping of his figures and minor accessories; hence he has a far greater command, within certain limits, over the materials of his compositions than the painter who has not only to design, but to execute all the parts which go to make up his picture. We say within certain limits, because the composing photographer cannot always conveniently obtain the real details of his design, whereas the originative painter can always paint what he finds to be wanting. But, on the other hand, the former can always command a variety of human figures to suit his ends, and he does not find it very difficult to arrange new dresses, which would involve much costly labour to paint. The painter stands in the position of the author who has first to invent his story, and then to put it into form upon paper, and superintends its transitionary stage in the hands of the printer, who puts it into presentable form for the public eye. The picture composer rather resembles the printer, who, with ready-made materials, finds for them an effective combination. If his trial combinations turn out spiritless or ineffective, he distributes his matter and goes to work again. There is the great difference, however, that the photographer must come to his task with no inconsiderable powers as an original designer, whilst he must also be somewhat fertile in such resources as will enable him to construct with facility the thousand and one little accessories which go to the production of even simple works.

The collodion process for the production of glass pictures—the last great step in the art—has lately received a valuable accession to its practice, in the shape of a method whereby dry collodion is made available as a means of remedying the inconveniences attending the moist material. According to the moist way, the artist must use his plate directly after being prepared, and hence he always finds his operations clogged by a host of preparing apparatus, peculiarly difficult of management for open air work. The dry collodion plate can be kept for a considerable time in readiness for effective use, so that the operation becomes wonderfully simplified from its use. Mr. Mayall, the well-known metropolitan daguerreotypist, has just completed a new process of this kind. In this way of operating, the common plain collodion is excited with three grains of iodide of cadmium, one grain of chloride of zinc, one ounce of collodion, and half an ounce of alcohol. The chemicals are dissolved in the alcohol, and they are then mixed with the collodion. This is Mr. Mayall's "No. 1" process. No. 2 has three grains of iodide of zinc and one grain of bromide of cadmium, or, as in No. 3, two grains of iodide of cadmium, one grain of bromide of cadmium, one-sixtieth of a grain of bromide of iron, and one-twentieth of a grain of bromide of calcium. In this last, it is necessary to dissolve one grain of bromide of iron in one drachm of alcohol, using one fluid grain of the solution. Similarly, three grains of bromide of calcium must be dissolved in one drachm of alcohol, using one fluid grain of the solution. The excited collodion must stand for a few days to settle completely, when it may be decanted into a dry bottle to prevent all chance of sediment. The spreading on the plate is just as usual.

The bath of albuminate of silver is prepared from sixteen ounces of distilled water, one ounce of albumen, one and a half ounces of neutral nitrate of silver, one and a half ounces of glacial acetic acid, and two grains of iodide of potassium.

The albumen and water are first well mixed, and then the glacial ascetic acid is added. The mixture is shaken up and allowed to stand for three hours, when the crystals of nitrate of silver are added. After shaking and filtration, the composition stands twenty-four hours, when the iodide of potassium is added; and after filtration, the bath is ready for use. When the plate is coated with collodion, this albuminate of silver bath is used as an ordinary silver bath. The treated plate is then washed for five minutes in another bath of distilled water, when the back of the plate is washed with common water, and the front with distilled water, when it may be set aside vertically to dry and to be stored for use, as it will keep in serviceable order for three weeks. The time in the camera is from two to ten minutes. After the exposure, the plate is deposited again in the silver bath for three minutes. The development of the image is effected with a wash of six grains of protosulphate of iron, one ounce of distilled water, and one drachm of glacial ascetic acid. After being washed, the picture is fixed with a wash of one part cyanide of potassium and twenty parts of water. It is about as quick as albumen in the camera. Neither the albuminate of silver bath nor the developing solution must be exposed to the light. Potassium and ammonium salts will answer for exciting the collodion; but it will not keep so long as with the metallic iodides. But all such expedients as this are mere makeshifts. Sensitive plates for field-work may be better prepared to effect all that is necessary, by giving the coating a permanently moist character. This is easily done by a film of sirup upon the plate after preparation in the usual manner. Such a wash preserves the prepared plate in good order for any necessary length of time, and it has the especial advantage of being particularly simple in treatment.

Mr. B. J. M. Donne, of Crewkerne, Somersetshire, has added some force to the impetus now being given to photographic progress by the issue of two parts of a "Photographic Album." This work, for five shillings, gives eight or nine pictures printed, or rather developed, from glass negatives originally obtained from nature herself. Three examples of these pictures are now before us. Their size is four and five inches by three. The best of these as a picture, is a farmyard study of animals, the prominent figures in which are a cow standing in front of a five-barred gate, with three sheep feeding from a trough close to a rugged wall. In the background is a farm labourer, and behind him a mass of foliage on either side, with a central distance. The effect is rich and telling, the foreground details being well brought out; but this is done at some sacrifice of what is behind. Another picture is a ploughman's team standing in front of a wood-built stable, with the driver mounted on one of the horses, whilst the ploughman stands by. This picture, although imperfectly developed, owing mainly to the interference of the shadows, is a good example of what photography can do in furnishing sketches for pictures, and recording the general outline of natural objects. We have but one example of Mr. Donne's figure work. This is the "Fisherman's Daughter," a three quarter length, holding a basket of trout. The background is not good, and too much shade is thrown upon the features of the face; but the fish are well done. They stand out from the flat of the paper with a full rich development, which must be very alluring to all sons of the angle. These results, as produced by a beginner, are very fair, and we must accord the more weight to them from the reason, that they are the work of one who has bestowed his time rather upon the maturing of a cheap mode of printing from negatives, than upon pointed excellence of effect. "I have endeavoured," he writes, "to bring them within the reach of the bulk of the public, who are certainly excluded from indulging their taste for possessing these types of nature by the high price at which these pictures have hitherto been kept." He suggests that they may be produced at a price very much lower than is generally supposed, so as, in fact, to become available in the illustration of delicate objects, such as would demand a greater power over minutiæ than the draughtsman or engraver can compass. As a useful reference book for artists, the "Photographic Album" is deserving of great commendation. The pictures, such as it supplies, are at least superior to matured sketches. They are better, because neither their outline, their perspective, nor their light and shade can ever be wrong; and if we were to look for another point of advantage, we should find that it is the simplicity and economy of their production.

The evanescent nature of photographic pictures generally, from time to time, causes serious consternation. As a means of investigating deeper into the subject than private and single-handed enterprise will permit, the Photographic Society have appointed a scientific committee of members to inquire into, and report upon the evil. The intention is a good one, and good results may be looked to from it, if carried out in the spirit of its conception.

Considered simply as a sketcher, the photographic camera cannot but be regarded as a most desirable assistant for the artist, the engineer, the man of science, and indeed for all who have recourse either to sketches or finished delineations on paper. Photographs being perfect transcripts from the great volume of nature, must always be rigid standards of perspective, of relative proportions, and, under certain circumstances, of light and shade. Where else can we find so excellent a master, or where are we to look for so trustworthy a text-book of reference?

THE SOCIETY OF ARTS' EXHIBITION.

II.

Rope Mouldings—The "Excelsior" Cotton Reel—Hoop-Iron Bond for Buildings—Ryder's Forging Machine—Folding Easel—Atmospheric Blowpipe—Out-of-door Photographic Camera—Knife Cleaners—Uncorking and Decanting Machine—Nixon's Rudder Fittings—Double-Handled Spade—Printing from Nature in Imitation of Wood—Roller Grainer for Imitation Wood Painting.

Mr. Sterry's "Patent rope moulding for circular and sweep frames" is a simple contrivance, presenting great facilities in the production of curvilinear work for the moulding decorator of houses. The rope forms the base or foundation of the moulding, and being attachable to its base surface with great ease, it serves a very important end in simplifying the construction of the moulder's ornaments, whilst it is cheap, and obviously particularly durable.

The Leicester sewing cotton manufacture is efficiently represented by Mr. J. P. Clarke, who displays his "Excelsior reel" to considerable advantage, the sample articles being finished up in a very elegant manner. Hitherto, as everybody knows, the reels or bobbins holding common sewing thread have always been made with solid ends, so that, by using a thick central barrel part, the purchaser of such articles at cheap shops might easily be deluded into the idea that they were obtaining good measure of the thread. By Mr. Clarke's plan, the fair outside can no longer lead to this false inference, for the ends of the "Excelsior bobbin" are slotted through, affording a clear view into the interior of the wound thread, and showing its real depth upon the bobbin. Advantage is taken of the new form, to add to the ornamental features of the reel, colour and varnish being laid on with great effect.

The "Patent hoop-iron bond for building purposes," by Mr. Tyerman, of Weymouth Street, is an improvement upon the ordinary bonding material used for binding brickwork together, in the way of increasing its holding capabilities. In this modified bond, the iron is notched to a depth of about one-sixth of its width, at intervals of twelve inches, on alternate sides; that is to say, any notch on one side is opposite to a blank space on the other side. One side of each notched or severed part is bent out to an angle of 45°, these bendings being in reverse directions as regards the two sides of the iron. This forms powerful reversed claws, which, when the metal is built into the brickwork, become embedded in the structure, and so prevent all chance of the hoop iron being drawn out. Erections put together with this binder are necessarily much better tied together than when the plain metal is used.

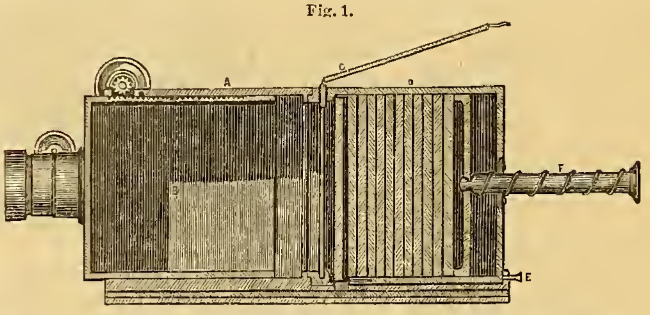
Mr. Ryder's well-known forging machine, for the rapid mechanical shaping of minor articles, such as rollers, spindles, and bolts, in wrought-iron and steel, deserves some comment, as being one of the most successful of the modern metal-worker's tools. The apparatus is simply an upright frame, having within it guides for a series of stampers with swage faces of different forms, worked by an overhead continuously-revolving cam or crank shaft. A machine, occupying a base of only four feet by three feet, with five stampers, and taking less than a single horse power, gets through an astonishing amount of work. A single machine, for instance, with three hands to superintend its operations, has drawn, swaged, and cut off, from $\frac{3}{8}$ square bar-iron, four tons and a quarter of $4\frac{1}{4}$ inch by $\frac{3}{4}$ inch bolts, ready for heading, in a week. This amount of work takes fifteen unassisted hands. Screw adjustments from below are provided, for the purpose of setting each swager to suit the exact size to which the drawing down is to be effected, so that no error as to size can ever occur. The chief secret in its working is its rapid action of some seven hundred blows per minute, by small degrees, so that the metal under it works well and kindly.

Mr. H. T. Williams, of Keppel Mews, Russell Square, has a "Folding easel," which offers some advantages to artists and artistical tourists in point of convenient portability. Its weight is but three pounds, but by a judicious combination of the parts, the inventor has succeeded in securing great strength and steadiness when in use. The tripod legs are jointed, so as to fold over into half their length, whilst the central pillar for the canvas slides through an eye at the junction of the legs. It folds down into a remarkably small space.

A "Portable atmospheric blowpipe," by Messrs. Davis of Bath, serves an important purpose in the pursuits of all who have recourse to small air-blasts. It consists of a cylindrical bellows, the two end lids of which are kept distended by a helical spring in the interior; and from the base of the bellows, a flexible tube passes upwards to the blowpipe orifice. The bellows being placed on the floor, the operator is enabled to keep up his blast, simply by the downward pressure of the foot on the upper board, as the reaction of the internal spring brings up the top board after each descent. By this plan, the present wearisome and injurious labour of the lungs is entirely obviated, whilst a pure atmospheric air-blast is given.

Our engravings annexed present two views of a "Photographic camera for taking pictures out of doors," and a new "developing bath," by Mr. T. E. Merritt of Maidstone. The camera is represented in sectional elevation. The body, A, of the camera chamber has in it a sliding front, B, adjustable by a rack and pinion movement. A dark chamber, D, is fitted to the back of the camera, and is contrived to hold a dozen or more prepared sensitive sheets of paper, placed between glass plates; or collodionised or albuminised glass plates may be similarly held. When a picture is to be taken, the dark chamber is removed, and the focus is adjusted by means of a ground glass field plate, at the part where the separate chamber joins the camera. This field plate is then removed, and the dark chamber is replaced, as in our sketch, and fixed up by a screw, E. Then, by a single turn of the coarse pitched screw, F, the front sheet of sensitive paper is brought up to the focus position, when it drops upon a sliding plate in the bottom of the camera. Light is now admitted, by raising the dark diaphragm cover, G. After sufficient exposure, the cover is shut down, and a partitioned box is passed along bottom horizontal grooves in the camera, until the first cell of the box is under the sliding plate carrying the sheet of paper which has just been subjected to the action of the light. The drawing out of this sliding plate now allows the sheet of paper to fall down into the cell, when the latter is closed by its loop. A second turn of the screw, F, of course, brings up the succeeding sensitive sheet, and so on, until the series is exhausted.

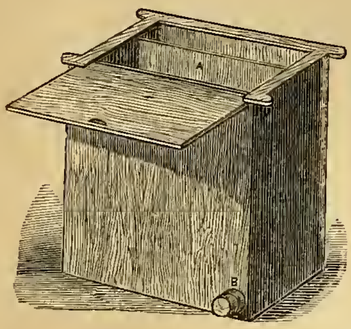
Fig. 1.



The developing bath, shown in our succeeding figure, is applied in this way:—

Being filled with pyrogallic acid, it is passed along the bottom grooves of the camera, just as the partitioned box was previously used. The picture is then dropped into the chamber, A, when the lid is closed, and the bath withdrawn. After development, the acid is poured off at B, and its place supplied by cyanide of potassium. The photograph is thus developed without any exposure to the light, and the artist may thus pursue his avocation in open daylight, without any fear of injuring his picture.

Fig. 2.



The "Self-feeding knife and fork-cleaning machines," by Mr. Terrett of Lambeth, are useful contrivances for economising domestic labour. They are in two forms, oblong and circular. The oblong one consists of two pieces of wood framing, one sliding within the other. The inner slide contains the apparatus for cleaning knives, consisting of two buff leather surfaces, each embedded upon a soft elastic support. The knives are inserted through apertures in the outer frame, and passed between the leather cleansers. The inner frame has a handle, by which it may be passed backward and forward until the knives are cleaned. The machine of circular action possesses enlarged capabilities, but its system of cleansing is the same.

The "Uncorking and decanting machine," by Mr. T. G. Shaw of Old Broad Street, is a neat little ornamental metal stand, carrying an inclined rest for the reception of the bottle during the process of uncorking. At the part where the bottle neck projects over the frame standard is a corkscrew, which steadily withdraws the cork from the neck, clamped in position upon the frame; and all the strain being within the frame itself, no shaking can ever arise. When the cork is out, the butler tips up the holding rest, with the bottle upon it, to the required angle for decanting the contents, without disturbing the crust or sediment.

The "Rudder fittings," by Mr. Nixon of Regent Street, are coming largely into use; and lately all the new boats to be built for the coast guard have been ordered to be fitted with them in Muntz metal. The rudder is so contrived, that in event of the vessel taking the ground or tailing on a reef, the rudder will rise of itself, and return again to its proper working position when again afloat.

We may recur to Mr. Wilson's series of inventions, to notice his double-handled spade, a modification of, or rather, perhaps, an addition to, the common spade. The addition is in the shape of a second handle, running parallel to the main lever, and supported upon it, close to the spade blade, by a pair of short pillar pieces. This secondary handle being on the upper side of the spade, comes considerably nearer the labourer's hand than the lever itself; hence the workman can accomplish filling work without inconveniently bending his back.

The process of "Printing from nature to produce imitations of ornamental woods," by Mr. Felix Abate, is highly ingenious and effective. It is based upon the well-ascertained fact of the extremely sensitive condition induced in vegetable substances by the joint action of acids and heat. The impressions, or fictitious woods, are produced from the natural wood itself, used as a matrix. The wood to be copied is exposed, in the first instance, to the effects of the cold evaporation of hydrochloric or sulphuric acid; or, instead of this gaseous treatment, it is wetted with dilute acid. The surface of the wood so prepared is then placed in contact with the cloth or paper on which the impression is to be produced, and pressure is given, so as to effect an invisible impression. Nothing is seen upon the impressed surface, until it is exposed to a strong heat, when a perfect representation of the figuring and graining of the wood is at once developed.

The "Graining instrument" of Mr. Bellamy is a totally different, but not less ingenious contrivance for effecting a similar end. It is intended for the production of elaborate "graining" effects, without involving the ordinary laborious manual process, which well-skilled artists alone can properly carry out. The invention is applicable either to painted wood or plain deal. The surface to be ornamented is first coated with graining paint, and whilst this is still moist, a cork or leather roller, carved in relief to the intended figure of the factitious grain, is rolled over it. The relief portions of the carved figure carry off all the paint with which they come in contact, thus instantaneously graining the surface in severely hard lines. This hardness is removed by passing a soft brush over the grained surface, thus partially closing up the lines, and bringing the figure to the proper degree of softness. We witnessed the execution of several examples of this kind, in the few minutes which we devoted to Mr. Bellamy.

Thus we leave the Exhibition until next year.

JENKIN'S CALCINING AND REDUCING FURNACES FOR LEAD AND COPPER ORES.

In this improved arrangement of calcining and reducing apparatus, two reverberatory furnaces are combined in such a manner as to considerably economise the fuel required, and to attain other important advantages.

Fig. 1.

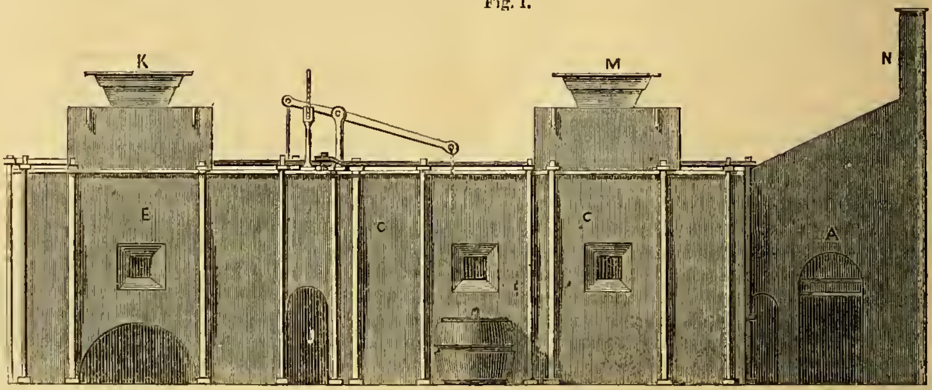


Fig. 2.

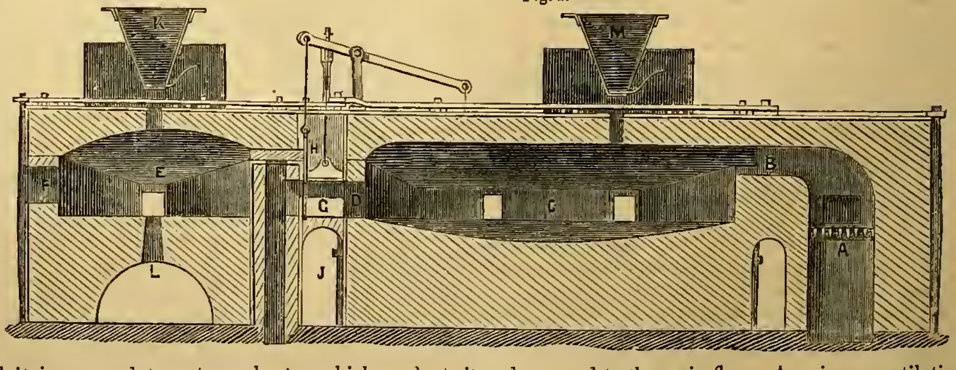
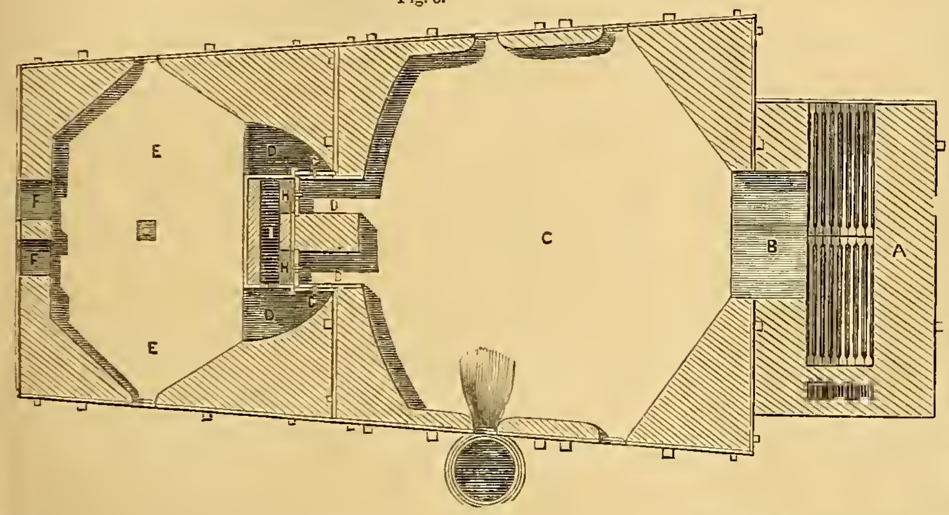


Fig. 1 of the annexed illustrations represents a side elevation of the improved double reverberatory furnace; fig. 2 is a corresponding longitudinal vertical section of the same, and fig. 3 is a corresponding plan thereof. A is the ordinary fire-place, the heat and flame from which pass through the lateral opening or flue, B, into the flowing furnace, C, and after traversing over the surface of the ore contained therein, enter by the passages, D, into the calcining furnace, E, which is on the same level with the floor of the flowing furnace. F are passages leading off to the main draught flue, or chimney. When it is required to shut off the heat and flame from the calcining furnace, the two dampers, G, are closed, and the pair of dampers, H, are elevated, thereby shutting off the flow from the passages, D, and diverting it into the descending or waste flue, I, which conducts it underground to the main flue. An air or ventilating space, J, is left between the calcining and flowing furnace, in order to prevent the bed of the latter furnace from becoming over-heated. The ore to be calcined is fed into the calcining furnace by the hopper, K, and is removed when calcined through the aperture, L, in the bottom of the furnace. A similar hopper, M, supplies the calcined ore to the flowing or reducing furnace. The small chimney, N, serves to carry off any dust or ashes arising from the fire when fresh fuel is supplied, or when it is otherwise agitated.

Various advantages are expected from the use of the improved double reverberatory furnace. The waste heat, after passing off from the flowing furnace, is economised and employed for effecting the calcination of the ore, instead of additional fuel being required for that purpose, whilst a slight portion of oxygen accompanies the waste heat from the flowing furnace in a condition to act on the ore in the calcining furnace, rendering it more easily worked, notwithstanding that it may be otherwise extremely refractory. As two charges of ore, weighing from 48 to 50 cwts., can be worked at the same time, and with one ordinary fire, an immense saving in fuel must necessarily be effected.

Fig. 3.



Much mischief frequently arises in the ordinary reverberatory furnace during the early part of the calcining process, but more particularly with refractory ore highly charged with sulphur and a variety of metals, such as zinc or antimony; and if not practically understood by the workmen in charge, the furnace becomes quickly over-heated, and, in consequence, a partial fusion takes place of the sulphuret of lead and some other ores when subjected to calcination. This mischief being done, is seldom repaired without a great loss both of labour and of metal. As a proof of frequent bad workmanship, or a want of knowledge in treating the ore, we need only refer the master smelter to the large quantities of quicklime used, than which nothing can be more injurious when used to excess, as is too often the case. It absorbs an immense quantity of protoxide of lead, nor can this be reduced in the slag-hearth, or otherwise, without a great loss. This mischief cannot well occur in the improved double reverberatory furnace, even with smelters of little experience; and the average loss of lead is stated not to exceed 5 per cent. on all ordinary ore.

The inventor and patentee, Mr. Alfred Jenkin, is now putting up his first furnace on the new system in England, at the C. B. Mines in Hartendale, near Richmond, Yorkshire, where they have hitherto employed daily six ore hearths, this well-known mining and smelting company feeling convinced that it is high time to do away with the present extravagant mode of smelting.

APPLICATIONS OF INDIA-RUBBER AS AN ELASTIC MATERIAL.

By Mr. W. C. Fuller, Bucklersbury, London.

(Illustrated by Plate 173.)

The recent extensive losses amongst our shipping in the Baltic and Black Seas, form a most appropriate text for a discourse upon one great branch of Mr. Fuller's applications of india-rubber for nautical purposes. The majority of maritime disasters may be laid down as due to want of holding power in anchors, and of strength in mooring cables and other details connecting the ship to the anchor. It is not so much the regular pull upon an anchor or cable which causes either to give way; this can be easily provided against; but against the sudden jerking action actually met with in a disturbed sea, calculations of strength become mere guesswork, and, in fact, the power of resisting the more severe blows and sudden strains to which the parts are occasionally liable, does not exist in the material of which they are made, as at present applied. In an immense number of, indeed we may say in all, mechanical contrivances on land, where similar concussions and sudden strains have to be dealt with, the objectionable action has been overcome to a greater or less extent by the application of springs, which, yielding to any increased strain, give time, as it were, to the resisting medium to bring its resisting powers into action, for it is from want of time to diffuse the strain over a sufficient extent of the resisting medium, that any sudden concussion or pull causes this medium to give way. Elastic action is of immense advantage in all cases where an unequal or irregular strain has to be transmitted or resisted, and this is the case as well proportionately, when the irregularities of strain are comparatively small, as when they are exaggerated. In towing or warping vessels, for example, the undulatory movement of the vessel caused by the nature of the floating medium, is of itself a cause of irregularity of strain upon the tow-rope, and the part of the vessel to which it is fixed. Again, in the rigging, both running and fixed, of ships, the actions of the sea and wind combine to render the strain very irregular; whilst, in the connections of a man-of-war's gun to the sides of the vessel, we have an example in which a more severe and sudden kind of strain has to be resisted. In all these cases, an incalculable saving must be effected in the wear and tear of the vessel, of the cable or ropes, and of all parts subjected to the irregular strain, by the interposition of an elastic medium of sufficient strength to ultimately resist any strain, but capable of yielding when the irregularity in the strain occurs.

The figures in our plate represent such of Mr. Fuller's contrivances for applying india-rubber springs in the circumstances to which we have alluded, as appear sufficient to illustrate the main features of his system.

In fig. 1 is represented a simple arrangement of spring, which may be applied in various situations, and is very convenient for connection with towing or other tractive ropes and details. The spring is composed of a number of cylinders, A, of india-rubber, arranged in a column with metal discs interposed between each. These cylinders act between a pair of discs, B, C, to the former of which a shackle, D, is bolted, the parallel portions of the arms of the shackle passing through eyes in the latter, which is fixed to a central bolt, E, passing through the cylinders, A, and through the plate, B. An eye is formed in the end of the bolt, E, by which it is connected to a fixed point, or to one portion of the rope or other detail transmitting the strain, whilst the other portion of such detail is attached to the bend of the shackle, D. Thus, when the strain occurs, the bolt, E, and shackle, D, are drawn asunder, causing the plates, B, C, to approach each other, and compress the cylinders, A, whereby the strain is greatly relieved. In the arrangement represented in fig. 2, the spring contrivance is a fixture; the india-rubber cylinders, A, being contained within a staple-plate, B, bolted to the framing, D, of the vessel or other structure. The resisting action of the cylinders, A, is exerted against a disc, C, to which a bolt, E, passing through the plate, B, and through the centre of the cylinders, A, is attached. An eye is formed in the other end of this bolt, to which a rope may be attached, and on any strain being applied thereto, the spring will yield by compression, and so relieve the strain. In fig. 3, the last described contrivance is represented as applied to the breeching rope of a man-of-war's gun. Each end of the breeching rope, F, of the gun, G, is attached to the bolt, E, of a spring, similar to that represented in fig. 2, and bolted to the side-frames, D, of the port-hole. In fig. 4 is represented a slight modification of the apparatus shown in fig. 1. The central bolt, E, is formed with a hook instead of an eye, and the column of india-rubber cylinders, A, being shorter, the disc, C, is not guided by the arms of the shackle, D. This shackle is formed with an eye, and is entered upon a fixed stud, H, about which it can swivel, being secured thereon by a nut. This modification is very suitable for application at the corners of piers, and upon posts or other fixtures used for the attachment of warping ropes. The bight of the warping rope being placed in the hook, E, the spring may be turned about in any direction, and from its yielding properties will considerably relieve the strain on the rope. In the modification represented in fig. 5, the india-rubber cylinders are enveloped by a case, I, which is substituted for the shackle, D, and is fixed to the plate, B. This is a very compact and convenient arrangement; one point of connection is at one end of the central bolt, E, whilst the other is at J, at the opposite end of the case, I. In fig. 6, a different mode of applying the spring power is represented. The tow-rope, K, is supposed to be held between the vice jaws of a riding-bit, L, which is capable of vibrating on a centre at M, upon the ship's deck for example. Immediately behind the riding-bit is a timber post or framing, N, or it may be one of the ship's windlass bits. At the back of this bit, N, are arranged one or more columns of india-rubber cylinders, A, the back plate, C, of which is linked to the riding-bit, L, by a central bolt or bolts passing through the resisting bit, N. Any strain on the tow-rope, K, acts on the riding-bit, and causes the spring to be compressed. In this arrangement, the tow-rope may be lengthened or shortened with great facility, by simply relaxing the hold of the vice jaws, L, and letting out or drawing in the rope. Fig. 7 is an elevation of a ship's bow, showing one mode of applying the spring to the anchor cable; a part of the vessel's side being represented as broken away, to exhibit the internal arrangement. The anchor cable, K, passes across a riding-bit, L, just within the hause hole; this riding-bit being provided with any convenient means of retaining a firm hold of the cable. The riding-bit is linked by rods, O, to the back plate, C, of one or more columns of india-rubber cylinders, A, arranged behind the windlass bit, N, through which the rods, O, pass. One or two india-rubber cylinders, P, are also put on the rods, O, in front of the windlass bit, N, to modify the reaction of the apparatus. The cable, K, being fixed in the riding-bit, L, its inner end, Q, is slackened off the windlass sufficiently, to allow of the play of the spring. When a sudden and powerful jerk tightens the cable, the spring yields, and thereby lessens the straining action. The springs employed in this manner must necessarily be very powerful, and they will not be acted upon in ordinary circumstances; but the bend of the cable, caused by its own weight, will allow of sufficient movement when the strain is not severe. The outlying portion of the cable may be increased or diminished with great facility, by removing the stopper from the riding-bit, the slack of the cable being, of course, first taken up by the windlass. The cable may then be either hauled in or allowed to run further out, after which the riding-bit stopper may be readjusted. Fig. 8, our final illustration, is a plan of a ship's bow, showing another mode of applying the spring power to the anchor cable. Here two or more springs, A, similar to that represented in fig. 1, are connected by bolts, or otherwise, to the windlass bits, N, at one end, and at the other by short lengths of chain, R, to one or two links of the cable, K. When the chains, R, are adjusted, the after-part, O, of the cable is slightly slackened by turning the windlass, and the strain is, by this means, thrown upon the springs

In constructing these various springs, Mr. Fuller does not confine himself to any particular section of india-rubber, selecting in each case that form which seems most suited to it.

BIGELOW, THE AMERICAN INVENTOR.

The subject of this notice was born April 2, 1814, in West Boylston, a small town of Massachusetts, seven miles north of Worcester. His father had a little farm, to the toils of which he added, with Yankee versatility, the business of a wheelwright and that of a chairmaker. The boy was sent, of course, to the district school. At the age of eight he asked his master to put him into arithmetic and writing, but he was pronounced too young for these high branches. He was not, however, to be headed off so. He took up Pike's Arithmetic at home, performed, unassisted, every question as far as the Rule of Three, and made a fair record of the whole. Who does not see in this a promising outset?

But his school and his arithmetic engrossed only a fraction of his time. His boyish activities showed early a mechanical tendency. With minute fence of regular post and rail, he enclosed a few yards of ground. This was *his* little farm. There might be seen a plough, a cart, a waggon complete in every part, with other implements of husbandry, all of his own making and of a size to match. His live stock was a litter of kittens. To carry out his idea, he must set them to work: a yoke was made, and two of these small steers were attached to the cart. Finding that they insisted on pulling backward, he turned their heads toward the cart. The wheels now went forward, but the team could not be guided; the experiment consequently failed.

Not content with being a farmer and a wheelwright, he went into the chair line. Having made a chair-back, he so finified it with paint and bronze and gold, that folks looked on with wonder, and predicted that the boy was destined to become a great painter.

He contrived to get a violin, and it was not long before he could execute with facility the then popular airs of "Bounding Billows," and "Away with Melancholy." This was a new phase. His career, evidently, was to be a musical one. Kind neighbours even suggested that he might hope ere long to find high and profitable employment in the orchestra of the Boston Museum, consisting at that time, if we remember rightly, of a fiddle and a hand organ.

John Temple, a neighbour of Mr. Bigelow, was a substantial farmer. He had noticed the lad's capacity, and sometimes jokingly asked him to come and live with him, and learn *his* occupation. Erastus regarded this proposition as a business matter. With him an offer was an offer. Accordingly, one Monday morning, in early spring, this boy of ten years presented himself at Mr. Temple's door and demanded employment. It was given him, with no expectation that he would continue through the day. He worked on, however, and at the end of the week suggested to Mr. T. that it would be proper to come to some understanding in regard to wages. On being asked his terms, he offered to work six months on condition of receiving at the close a cosset lamb, called "Dolly," to which he had taken a strong liking. The moderate demand was of course acceded to. But scarcely had a month elapsed ere a difficulty arose. Dolly could not live without eating, and how was he to provide for her? His fellow-labourers discovered the cause of his anxiety, and teasingly aggravated it. At length he proposed and effected an alteration in the contract. He relinquished his claim to Dolly, and Mr. T. agreed to furnish, instead, a pair of cow-hide boots, and sheep's-gray cloth sufficient for a suit of clothes. The agreement was fully carried out on both sides. At the close of the period, an offer of four dollars a month for the ensuing summer was made and accepted. The kind-hearted man, at parting, gave the young farmer a silver dollar.

During the next two years he continued to work for Mr. Temple in the summer, and to attend school in winter. The farmer urged him to stay till he should be of age, and he offered to do so, if, at the close of the term, he could receive in compensation a small outlying farm belonging to his employer. Fortunately, this offer was declined. It was an escape not unlike that of Daniel Webster from the clerkship of the county court.

In 1827, Mr. Bigelow removed to another part of the town, and engaged in the manufacture of cotton yarn. Erastus was set to work in the mill. So long as he found anything to study in the machinery and its working, he was interested; the occupation then become distasteful. While employed in this drudgery of tending spindles, he was busy in framing plans for the future. His grand desire was to obtain a liberal education. As his parents, from their limited circumstances, could not encourage him in this, he began to consider in what way he might accomplish the object himself. He already knew how to earn and to save. He had not only clothed himself by his toil, but to his first silver dollar had added several more. Like Goldsmith, he now turned his musical talents to account. In a community where critical connoisseurship was unknown, he passed for an accomplished performer. At all balls and dancing parties for many miles around his services were in request. After a long day of spinning, how tedious must have been a whole night of fiddling! Often, doubtless, his eyelids grew heavy and his arm a-weary. Who can think of the motive which nerved that arm, without respect for the young violinist?

About this time he made his first invention. It was a hand-loom for weaving suspender webbing. It accomplished the object; but as the business would not justify the employment of an operative, he abandoned it after realizing from it a few dollars. His next invention was of more importance. A ball of cotton cord, known in the market by the name of "piping cord," had been brought into the house for domestic use. On examination, he found it to be of yarn, like that which he was spinning every day. On inquiry, he learned that it was made by hand in the ordinary rope-walk. He was sure that it could be formed more expeditiously and cheaply by automatic machinery. In a few weeks he had matured the plan of a machine, and within two months he had it in successful operation. It worked well—earning for the youthful inventor, in the course of a year, about one hundred dollars. At length the article fell greatly in price, and the working of the machinery was abandoned.

These first developments of a peculiar genius were evidently called forth by his burning desire for an education. They were temporary expedients to enable him to pay his way. It should not be forgotten that they were the achievements of a lad only fourteen years of age. Having now, by his industry and ingenuity, acquired a small fund, he obtained parental consent to attend a neighbouring academy at his own expense. This was in 1830. Here he entered on the study of Latin. His teacher was pleased, and wrote to the father recommending a collegiate course for the boy. But to the cautious parent, a trade seemed safer and better. As the son preferred not to engage again in the dull employment of the spinning mill, the matter was compromised, and he was told that he might go to Boston and become a commission merchant if he could.

To Boston accordingly he went. He carried no letters—knew no one. After a few inquiries from door to door, he found employment in the wholesale and retail dry-goods establishment of S. F. Morse & Co. The firm was highly respectable, and the place was deemed a good one. But the charm of novelty was soon over, and then the occupation of measuring and selling ribbons and calicoes seemed petty and monotonous. He felt, he knew that he was made for something beyond *that*. The idea of a college course still haunted him. On one occasion he walked out to Cambridge, and had a talk with President Quincy. It only served to show that there was no chance yet for him.

About this time a teacher of stenography came to Boston, and gave lessons in the art. He drew much attention and formed large classes. Our young clerk shared in the general interest, but the cost of a course (ten dollars) was beyond his means. So he got some books and taught himself. He was surprised to find the art so simple. In a few days he could write with ease in short-hand. A new thought struck him. If *he* could learn stenography in this way so quickly and easily, why should not others—why should not many avail themselves of the useful, labour-saving process? The rareness of the acquirement must be owing to the expense. He would obviate that. He would write a book on short-hand, illustrated by plates, and filled with rules and examples. Energetic and industrious—to resolve, with him, was to act. In a short time his work—"The Self-taught Stenographer"—was ready for the press. To prosecute this new enterprise, he relinquished his post behind the counter, much to the regret of his parents, who naturally questioned the expediency of the step, and to that of his employers, too, whom he had fully satisfied.

Having printed a small edition of his work he became his own bookseller, and in ten days sold seventy-five dollars' worth in Boston alone. This greatly encouraged him. Forgetting that Boston was peculiar and prepared ground, he regarded his sales there as an exponent of the national demand, and immediately ordered a large impression of the work. To meet the extensive business now opening upon him he took a partner, a medical student, who was anxious to see a little of the world before he settled down as a professional drudge. The young doctor was to pay the entire cost of printing, to share equally in the labour and expense of distribution and sale, and to receive one-half of the profits. These hopeful adventurers set out at once upon their commercial travels. They visited the most inviting portions of New England, New York, New Jersey, and Pennsylvania. Here the cholera, then on its first terrible march through America, put a stop to their journeyings. They went home, having made about a hundred dollars. Four hundred dollars were still due the printer, a large part of the edition was yet on hand, and all the best ground had been canvassed. It looked decidedly dark. Young Bigelow, without hesitation, released his discouraged partner from the pecuniary obligation.

Behold him now at the age of eighteen. His little educational fund has vanished, all his schemes have failed, and he is four hundred dollars in debt. His father, in the meantime, had been extending and diversifying his business. He had formed a partnership with the celebrated "John Smith," and a new mill had been erected for their operations. As the old mill now stood idle, Erastus thought that he might turn it to some account. In this project he found a person willing to join him. John Munroe was the name of his second associate. Their business was the manufacture of twine. It was beginning to be moderately successful, when a disagreement between Smith and his partner put a stop to the operations of the younger firm.

Bigelow and Munroe then undertook to run a cotton factory in Wareham, a place in the eastern part of Massachusetts. At the end of nine months this arrangement terminated in a loss. As author and as manufacturer, he was now obligated to the extent of fourteen hundred dollars. In Massachusetts his way seemed completely hedged up. But Massachusetts is not the only place in the world. Soon after this we find our hero in the city of New York, taking lessons in penmanship of the renowned Professor Bristow. His improvement astonishes even himself. A dozen exercises have transformed a poor writer into an accomplished penman. Then, for some time, he supported himself by teaching the art. Newark, and several other large towns in New Jersey and on the North River, enjoyed the benefit of his instructions. He was not the person to be content with such a life. Indeed, he soon became deeply dissatisfied with that and with himself. An important period of his existence was passing away in desultory and unprofitable efforts. He was conscious of powers that needed discipline only to insure him success. His literary aspirations returned in full force. But, alas! what could he do?

In this state of mind he returned home. His parents received him kindly, but could not suppress their anxiety concerning his future. In that humble family council many plans were started and rejected. At length, with unanimous approval, the youth resolves to become a physician. After a winter passed in classical studies at Leicester Academy, he entered his name as a student in medicine. This study he prosecuted with diligence for more than a year, being much interested in the science, but constantly annoyed by a sense of his imperfect literary preparation. Even then, could he but find the means, he would go back, to start anew and aright. Again the stimulus of this early and strong desire put him on the look-out for some source of pecuniary gain. With his mind in this state, he happened, while on a visit, to sleep under a knotted or Marseilles quilt. Years before he had seen similar fabrics woven by the slow and costly process of the hand-loom. Why—he now asked himself—could not a power-loom be made to weave them? It was not until a year afterwards that he set himself in earnest to solve this problem. Having suspended, for a time, his medical studies, he matured the plan of a loom. With some pecuniary aid he was enabled to construct the machine, which worked to the satisfaction of all.

But to prosecute the enterprise, capital must be had. In quest of this he went to Boston. A sample of the fabric was shown to Messrs. Freeman, Cobb, & Co., who were large importers of the article. Satisfied that it must succeed, they entered at once into an agreement, contracting to pay all expenses thus far incurred, to be at the cost of patents for this country and for England, and to erect and furnish a mill that should meet all probable demands of the market. In consideration of this contribution, the inventor was to receive, free of expense to himself, one-quarter of the profits. A brighter day had, at length, dawned on the struggling youth. He had reached the position so long sought. He could now secure a thorough education. Accordingly, he renewed his studies under the care of a clergyman, who was in the habit of fitting young men for college. Must we state that even this fair prospect was soon clouded? Freeman, Cobb, & Co. failed in business. The period was one of commercial depression, and was, therefore, no time to raise capital for new enterprises. To increase his embarrassments, his father had been unsuccessful in his affairs, and was now in declining health. His own position and his sense of filial duty left him no alternative. The sternly-exacting present must be provided for. Postponing to an indefinite future his half-realized schemes and hopes, he once more relinquished his classical studies.

While, to meet the exigency, he was earnestly considering the question of "ways and means," an incident of travel recurred to his memory. In his stenographic journeying he had accidentally witnessed the process of weaving coach-lace. At the time, he had felt no interest in the matter—had taken no note of the details. He only rememberd that hand-looms were employed. With this recollection, the idea of a power-loom immediately presented itself. Two days' study convinced him that the thing could be done. But another point must also be settled: would it pay? He was wholly unacquainted with the character and extent of the coach-lace business. Hiring of a neighbouring farmer his work-horse and old yellow-bodied chaise, he starts, with characteristic promptness, on a tour of inquiry. The carriage-makers of Worcester, Grafton, Framingham, Medway, and Dedham, were successively visited and interrogated. The result was a general reference to Messrs. Fairbanks, Loring, & Co. of Boston, venders of the article, with whom these mechanics all dealt. Into Boston accordingly went the yellow chaise. Messrs. Fairbanks & Co. settled every doubt. A coach-lace power-loom, they said, would certainly do well; but the thing had been often considered by the principal lace-makers, and pronounced an impossibility. They expressed a wish to join with him in case of his succeeding—though, as they afterwards confessed, without the slightest faith in the project.

Mr. Bigelow went home, and with no other guide or help than a piece of coach-lace, set himself to the accomplishment of a task which, up to that time, had been deemed impossible. Spurred on by necessity, and encouraged by a confident hope of success, his mind became intensely active. To others, indeed, he seemed to have grown suddenly stupid. When spoken to, he appeared to listen, and yet showed by his silence or inapposite reply that he had not understood a word. One evening he was asked to show a visitor the way out. To the surprise of the latter he took an unlighted candle, marched silently before him through a long, dark entry, and gravely bowed him from the door. During this period of mental abstraction he took no note of time. He sat in the family circle with as little share in the conversation as if he had been deaf and dumb. All hints about bed-time were thrown away upon him, and the unmoved candlestick, whose taper had expired in its socket, usually showed in the morning that he must have gone off to his rest, at some late hour, in the dark.

The fruits of this extraordinary application soon appeared. Within six weeks from the time of its first conception, he had a power-loom in successful operation. Let any one examine this beautiful and complicate piece of mechanism, in which iron seems to act like an intelligence, and exhibits a dexterity which human fingers scarcely surpass. Let him consider that this machine involved all the essential principles of a far more important one—the Brussels carpet loom; that the inventor was a young man not twenty-three years old, who had never even looked into a treatise on mechanics; and finally, that all this was accomplished in the brief space of forty days; and he will, at least, allow that the history of useful art exhibits few such instances of mental and executive efficiency.

Thus far we have traced, with some particularity, the ardent aspirings, the varied efforts, the successive struggles and disappointments of a poor but persevering youth. It shows what may be accomplished by high aims, a fixed purpose, and resolute industry. It will appeal to the warm sympathies of those who love to contemplate the development of mind and character under a discipline of hardship. We have followed a rivulet from its mountain spring. Obstacle after obstacle has opposed its progress. But above, or round, or through them all, it has still forced its way. In one bright flash, it has just leapt over the last wall of rock. It becomes a deep broad river; its banks widen out and wave with fertility. But we must not be disappointed if we miss, henceforth, the picturesqueness of its upper course.

The complete success of the coach-lace loom brought the inventor at once into notice. Fairbanks, Loring, & Co. of Boston, John Wright of Worcester, Israel Langley of Shirley, together with the inventor and his brother Horatio, united for the purpose of building and running the looms. This association afterwards became the "Clinton Company." Mr. B. was now in a condition to carry out his early and long-cherished, though often frustrated, wish in regard to education. But the time for that scheme had, he felt, gone by. He had become better acquainted with the nature and measure of his own capacities. He saw opening before him a career of activity, success, and usefulness. To this, accordingly, he resolved to devote his future life.

Soon after the Clinton Company began its operations in Lancaster, the affairs of Freeman, Cobb, & Co. had become so far adjusted as to liberate from its legal embarrassment the counterpane loom. One of the firm immediately contracted with the inventor, on terms highly favourable to the latter, for a number of the looms. But Mr. Bigelow, happening soon after to be in New York, saw there a new and different species of counterpane, then just introduced from England. An examination of this fabric convinced him, not only that it would be more marketable than the knotted counterpane, but that it could be made at less cost. With a disinterestedness hardly less rare than his ingenuity, he advised Mr. Roberts to give up the contract, and thus lay aside entirely the very curious and perfectly successful loom already made. He at the same time agreed to invent a power-loom for weaving this new fabric. Within six months from that time he had such a loom in successful operation. A small mill in Lancaster was filled with the machinery, and the business, steadily prosperous, has remunerated the inventor and enriched others.

After starting the coach-lace and counterpane establishments, Mr. Bigelow took up the question of weaving the ingrain or Kidderminster carpet by means of power-looms. It was no easy matter to produce a fabric in which the figures should match, which should have a smooth, even face and perfect selvedge, and do this with a rapidity so much beyond that of the hand-loom as to make it an object. The hand-loom weaver can, to some extent, meet these conditions by the exercise of his judgment. If the shuttle has not fully done its work, he can give the weft-thread a pull with his fingers. If, on measuring, he finds that the figure is getting to be too long or too short, he remedies the fault by putting either more or less force to the lathe as he beats up. If he perceives that the surface of the cloth is becoming rough, he regulates the tension of the warps. By the exercise of constant vigilance, skill, and judgment, he can *approximate* to the production of a complete and regular fabric. But how shall these properties be imparted to inert matter? How shall iron be taught to observe, to judge, and to vary its action with such modifications as the case may require?

To the achievement of this seeming impracticability, our inventor now addressed his extraordinary powers of analysis and concentration. A short study assured him that the idea was feasible. On the strength of this conviction—before he had made a model or even complete drawings of the machine—he entered into a written contract with a company in Lowell, to furnish them with power-looms for making ingrain carpets. His first loom for two-ply carpets was set up within a year. In the matching of its figures, in evenness of surface, and in the regularity of its selvedges, its product far surpassed that of any hand-loom. Its average daily work was from ten to twelve yards; that of the hand-loom is about eight yards.

He *must*, he *could* do better than that. A second loom, with various modifications and improvements, was ere long produced. By this the daily product was raised to eighteen yards. Still he was not satisfied. A third machine, with essential variations, at length appeared. This loom made, with perfect ease, from twenty-five to twenty-seven yards a day. The others, of course, like his first counterpane loom, were thrown aside. This loom was started in the summer of 1841. In the autumn he went to England. During this short visit, the manufactures of that country naturally drew his special regard. He at once saw that, in some important particulars, the English manufactures were in advance of ours. His opinion to this effect, frankly expressed on his return to Lowell, was received at first with murmurs of surprise and incredulity. It was not long, however, before the practical adoption of his suggestions showed that they had taken full effect. In 1842, the several manufacturing corporations of Lowell paid a deserved tribute to Mr. Bigelow's knowledge and skill, by creating a new office, with a liberal salary, and appointing him to fill it. His duties were to make improvements and suggestions, and, generally, to advise and consult with the agents of the respective companies. In this capacity he brought forward some important improvements, which were adopted by all the cotton mills of Lowell. Finding his new office too general in its character and duties to give results satisfactory to himself, he resigned at the end of eighteen months, and with his retirement the office itself expired. During this period he built, for the Lowell Company, a mill to receive his power-looms; and thus started the first successful power-loom carpet factory recorded in the annals of manufacture.

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RECENT PATENTS.

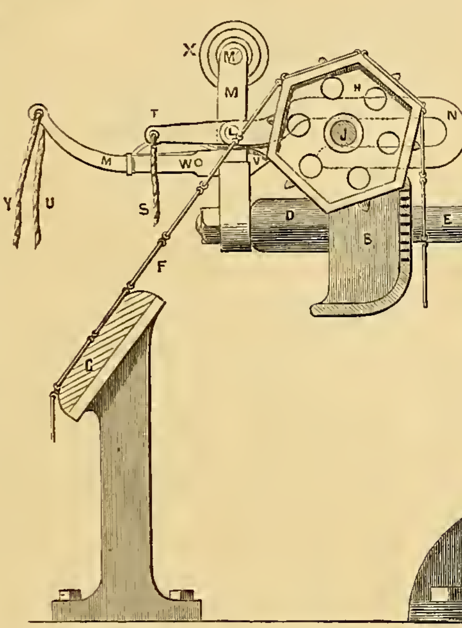
JACQUARD APPARATUS FOR WEAVING CARPETS.

J. & T. Lamb, *Kidderminster.* — *Patent dated August* 16, 1854.

This patent comprehends various modifications of, and additions to the jacquard apparatus employed in weaving Brussels carpets, their object being the obtainment of a greater certainty of action, and a diminished liability to derangement. Some of the improvements are also applicable to jacquard apparatus for weaving other than carpet fabrics. Figs. 1 and 2 of our engravings are combined transverse vertical sections of the jacquard apparatus, exhibiting the improvements. The details of the mechanism are carried by two cast-iron end standards, A (fig. 1), which are bolted down on to the framing of the upper portion of a carpet or other loom, and are tied together, near their base, by two transverse tie rods, B, and at the top, by a metal frame, C, to which is screwed the suspension board, D. This frame, C, works on swivel centres at E, the ends of which are formed with eyes, through which pass the vertical screw spindles, G. These spindles are for the purpose of raising or lowering the suspension board, and adjusting it exactly to suit the length of the knot cords, H. An angular adjustment, or inclination, may also be given to the suspension board, if required, by turning it slightly on the swivel centres, E; and it may then be fixed at any desired inclination by tightening the set screws, I, which are attached to the ends of the frame, C, and slide in the circular slots, J, in the upper portion of the side standards. The knot cords, H, are attached to the suspension board in the ordinary manner, and pass down through the trap board, K, which is represented as elevated in the figure. This board is gradually brought into the inclined position shown in the drawings during its upward movement, in order that the figure yarns which are brought into action may be raised evenly, and form a regular and even shed. This inclination is given by the actuating levers, L, which are jointed at M to the sliding links, N, to the top of which the trap board, K, is secured. The levers, L, are made fast on the transverse rocking shaft, O, which works in bearings in the side standards of the machine; and this shaft is actuated from a tappet shaft in the loom, by means of a connecting rod and lever arm, which is keyed on the end of the rocking shaft. The links, N, which carry the trap board, are connected by a pin, or bolt, to the upper ends of the vertical slides, T, through which this bolt passes, and works loosely. These slides work in the vertical slots, U, in the side standards, and are connected with segment levers, working loose on fixed stud centres, outside the side standards, by means of short links, which are attached at their upper ends to the pin or bolt in the vertical slides, T, while their lower ends are jointed to the segment levers by studs, which are adjustable, in concentric slots, on the segment levers.

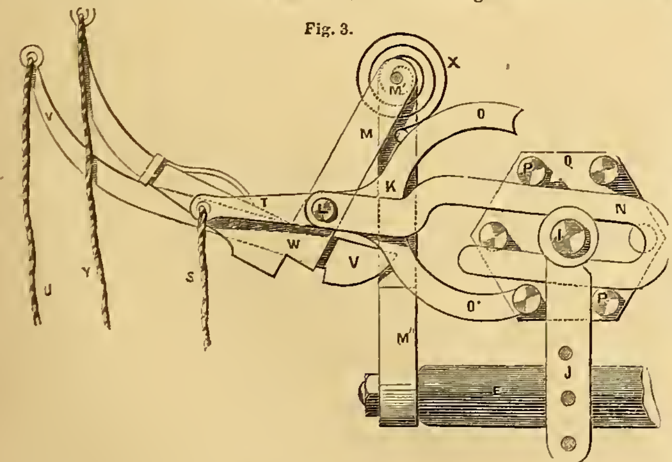
A curved link is attached at one end to each of the segment levers, and is connected at the opposite extremity with the studs fitted into the ends of the needle actuator, B (fig. 2). This needle actuator, which is substituted for the ordinary moveable jacquard cylinder, is composed of a cast-iron plate, which is drilled through, to correspond to the needles, C, of the jacquard, and is formed with a perfectly flat and even face. This plate has two long sliding bosses, D, cast upon it, to enable it to traverse freely, back or forwards, along the slide spindles, E. This traversing movement, which is necessary to bring the card, F, up to the ends of the needles, is obtained from the mechanism which actuates the trap board. In figs. 1 and 2, the needle actuator is represented as being pushed out. When the trap board, K (fig. 1), is at the bottom of its stroke, in place of being inclined, as is shown in fig. 1, it assumes a horizontal position. The cards, F (fig. 2), are guided by the fixed rail, and pass over, and are fed forward, by the carrying frames or discs, H, fast on the shaft, J, which works at each end in bearings, bolted to the ends of the needle actuator, B.

Fig. 2.



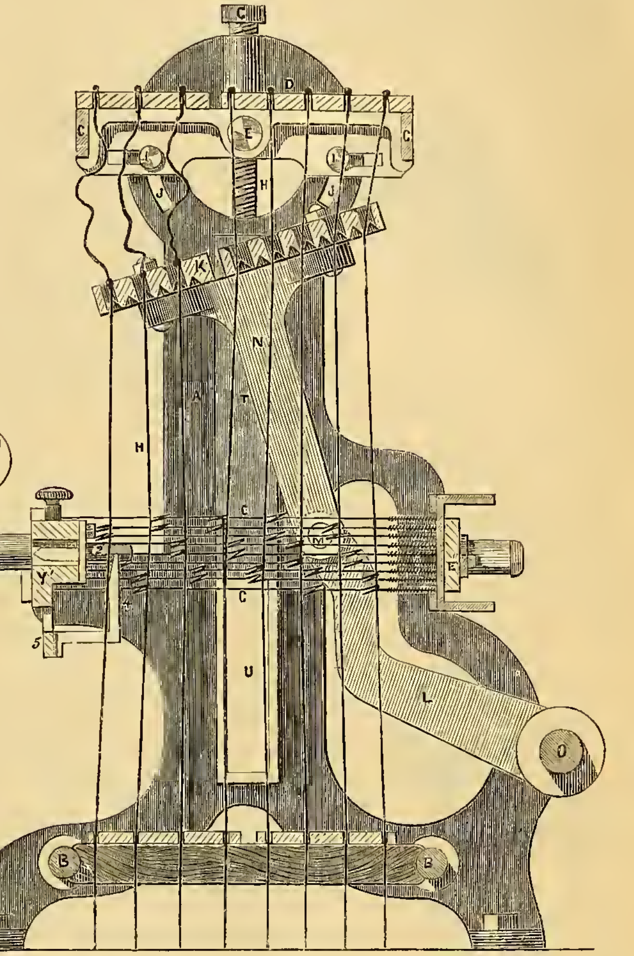
The requisite intermittent rotatory motion is given to the card-carrying frames or discs, H, at each back traverse of the needle actuator, by means of the catch, K, as represented in the detail, fig. 3, which works loosely on a stud centre, L, in the cranked lever, M. This lever works on a stud centre, M′, in the vertical bracket or arm, M″, which is bolted to the end of the guide spindle, E. The catch or pall, K, is made double-acting; that is to say, either the upper or lower one of the two arms, O O′, may be brought to bear against the stud pins, P, in the hexagonal disc, Q. When the machine is in ordinary working, the upper arm, O, will be generally in action. The disc, Q (fig. 3), is fast on the end of the shaft, I, of the card-carrying frames; and at each backward traverse of the needle actuator, one of the studs, P, will be brought into contact with the upper arm, O, of the catch K, and a partial turn, or a sixth of a revolution, will thus be imparted to the card-carrying frames, H. This amount of rotation is regulated and controlled by the length of the catch, K, and by the pressure of a T piece, which is kept pressed up against the under side of the disc, Q, by a helical spring, thereby holding the frames steady after each successive movement imparted to them.

Fig. 3.



By bringing the lower arm, O′, of the catch, K, into action, as shown in the detail, fig. 3, the motion of the card-carrying frames will, of course, be reversed; and this reverse motion may be obtained by first drawing and holding down the cord, S, attached to the tail, T, of the pall, K, which will have the effect of raising or disengaging the upper arm, O, and engaging the lower one, O′.

Fig. 1.



When it is required to turn back or reverse the cards, the weaver will merely have to draw down the second cord, U, attached to the tail of the spring sneck or catch, V, which works on a stud at W, in the cranked lever, M, and serves to hold that lever fixed during the regular working of the loom. But when the sneck, V, is elevated, as shown in the detail, the coiled spring, X, on the working centre of the cranked lever, M, will turn back that lever, and draw with it the pall, K, on giving a pumping motion to this lever, by means of the third cord, Y, and holding the sneck cord, U, in the same hand, so as to keep the sneck disengaged. It will be obvious that a reverse motion will be given to the card frames, so long as the lower arm, O′, of the pall, K, is kept in action by holding down the cord, S, with the other hand, during the working of the cranked lever, M. When the proper card is brought back into its place, the sneck cord, U, is released, and the cranked lever, M, pulled down into its original position, where it is held secure by the engagement of the sneck; and the pall, K, is then allowed to resume its original position, when the regular onward movement of the cards will recommence. The upward movement of the cranked lever, M, when released, is controlled by the hooked plate or stop, N, which is connected to the working centre of the pall, and is hooked over the shaft, I. A stop pin is fitted into the pall, K, which will come in contact with the under side of the hook, N, and so prevent the lower arm of the pall, also, from being elevated too far.

The detail, fig. 4, represents a transverse section of the shield or guard plate, Y, and needle actuator, B, with a card between them, in action. They are both perforated to receive the ends of the needles, which, being perfectly concealed in the guard plate when not in action, are consequently entirely protected from injury, and run no risk of being bent. This shield is supported in end bearings in the side standards, which allow of a slight forward traverse being imparted to it by the onward movement of the needle actuator when pushing back the needles, thereby allowing those needles which correspond to holes in the card to pass through the actuator, as shown in the detail, fig. 4. This shield, when pushed back by the needle actuator, carries with it the slide rods, E, into which it is secured for the purpose of actuating the back board, E″, which is fitted on to the back ends of the spindles, and is brought into its original position again by helical springs. Through this shield work four guide studs or pins, 2, which are made to move out from the face of the shield, and meet the cards as they are brought forward on the face of the needle actuator. These guide pins are adjusted to enter the nipple or peg holes of the cards, and when they have passed through them they enter into corresponding holes or slots in the needle actuator, so that the cards are not only squeezed up between the shield plate and needle actuator, but they are always retained and presented in a proper position to the needles by the guide-pins, 2. These guide-pins and their mode of action will be more readily understood on referring to the sectional details, figs. 5 and 6. They each work perfectly loose and free through small sliding blocks, 3, which are fitted into slots in the shield plate, and serve the purpose of lateral adjustment. The back end of each guide-pin is nicked or slotted, and fits loosely on the upper edge of the cranked arms, 4, which are attached at their lower ends to the transverse rod or bar, 5. This rod works in bearings, fixed to each end of the shield plate, and a rocking motion is imparted to it by a bent or inclined lever arm, keyed on one end of it, which arm slides over, and is actuated by an anti-friction pulley, carried by a stud on the end of the needle actuator. When the needle actuator is pushed back, the bent lever arm will be slightly elevated, according to the amount of inclination or bend given to it, and the guide-pins, 2, will be drawn back into the shield; but as the actuator advances, the bent lever gradually falls by its bent portion sliding over the pulley, and this descent of the lever allows the cranked arms, 4, to move forward and push out the guide-pins, 2, the points of which pass through the peg holes of the cards, and into a corresponding slot in the actuator, as shown in the details, figs. 5 and 6. When the actuator moves back again, the lever is elevated by sliding over the pulley, and the cards are released by the consequent withdrawal of the guide-pins therefrom. The position of the guide-pins is adjusted laterally to suit the exact length of card, and allow for any expansion or contraction in their length, through atmospheric changes, by means of the small eccentric adjusting-pins or cams, 9, shown in fig. 6. These adjusting-pins may be formed with a milled head for the convenience of turning them, and their lower or eccentric portion fits into a slot in the sliding block which carries the guide-pin, while their upper portion works in a suitable hole drilled vertically in the upper edge of the shield; the sliding blocks, when properly adjusted, are fixed in their slots by the set screws, 10, in order to prevent the nipple or peg-holes in the cards from becoming worn or enlarged, it is proposed to insert into such holes metal eyes or eyelets.

Fig. 4.

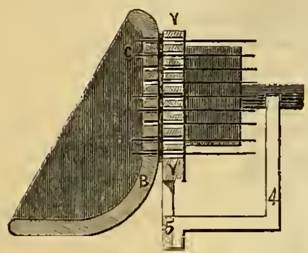


Fig. 5.

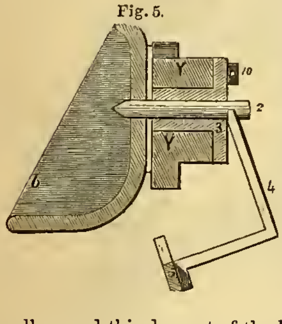
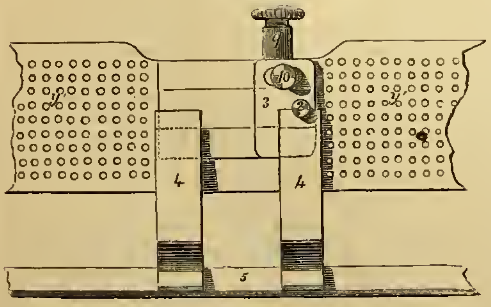
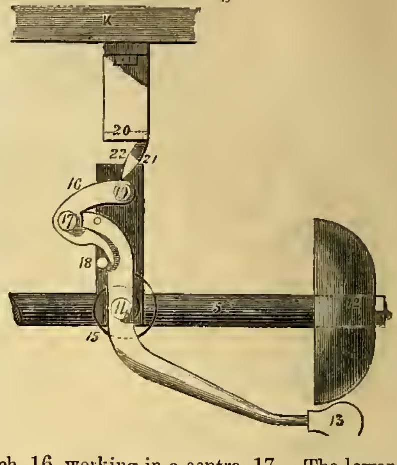


Fig. 6.



A bell or other alarum apparatus 12 (fig. 7), is fitted on to one end of the rod or bar, 5, for the purpose of giving notice to the weaver when any one of the cards has not been properly presented or accurately adjusted in front of the needles. This is effected by means of the striking hammer, 13, which works loosely on a stud-centre, 14, fixed in the back of the cranked arms, 4 (figs. 4 and 6). A coiled spring, 15, serves to keep the head of the hammer within a short distance from the bell, so that when it is released, after having been pushed back, it will instantly fly up to the bell and strike the same, thereby giving notice to the weaver of the incorrect working of the apparatus. On the upper end of the hammer shank is fitted loosely a small cranked catch, 16, working in a centre, 17. The lower end of this catch is hooked, and when the striking mechanism is being acted upon bears against a stud, 18, fixed in the cranked arm, 4. A stud, 19, is fitted into the other end of this catch, and stands out at right angles from it. This stud is acted upon and pressed laterally when the alarum is to be sounded by the descent of the cranked inclined stud, 20, which is fixed to the under side of the trap-board, K (fig. 1). When one of the cards is not properly presented in front of the shield, Y, the guide-pins, 2, as a matter of course, will not coincide with the nipple or peg holes in the cards, and as the card is pushed forward by the needle actuator, it follows that the guide-pins, in place of passing to the cards, will be pushed back by them, thereby bringing the cranked arms, 4, into a vertical position, as shown in the detail, fig. 4. This has the effect of bringing forward the stud-pin, 19, underneath the cranked inclined stud, 20, which, on the descent of the trap-board, will press against one side of the stud-pin, 19, and by the leverage of the hooked end of the catch, 16, against the stud, 18, will force down the head of the hammer, 13, which, on being released by the stud, 19, slipping over the top of the inclined side, 21, of the stud, 20, will instantly rise and strike the bell, 12. As the cranked inclined stud, 20, attached to the trap-board, rises again, its upper inclined edge, 22, slides along the under side of the stud-pin, 19, the moveable catch, 16, allowing of the free rising of the cranked inclined stud, 20. In place of employing an alarum to be actuated by the striking mechanism, the same mechanism may be made to release a stopping handle at the required time, and so stop the loom by any of the well-known arrangements at present in use.

Fig. 7.

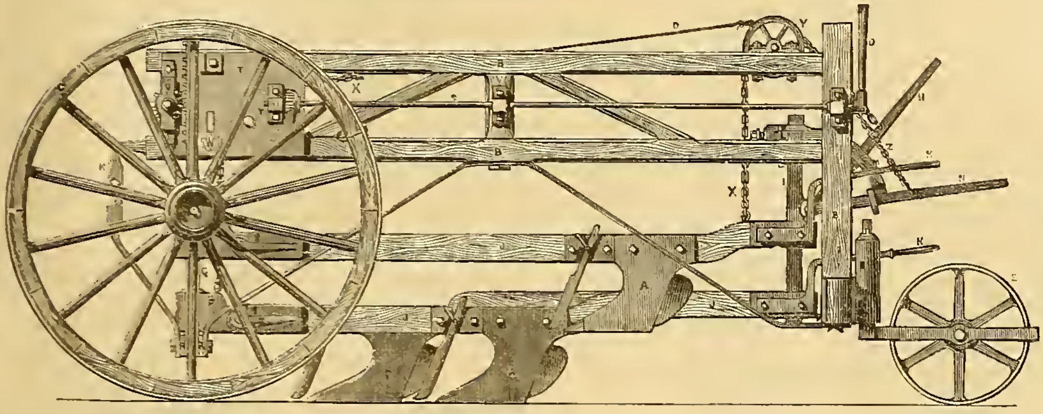


LAND CULTIVATOR.

J. A. Williams, *Baydon.—Patent dated June 17, 1854.*

In this cultivating apparatus, three or any other convenient number of ploughshares are combined in a frame or carriage, and are provided with various contrivances for facilitating their general and individual adjustment, according to the precise nature of the work to be performed by them. Our engraving represents the cultivator in side elevation.

The ploughshares, or other cultivating instruments, A, are carried by a rectangular framework, B, of timber or other material, made long and narrow according to the number of ploughshares, or cultivating instruments, fitted into the machine. This framework is carried at its front end upon a pair of large wheels, C, running loose upon separate axles. The axles of these wheels can be set at different levels to suit the depth of furrow to be made, or any irregularity of the surface, over which the machine travels in ploughing or cultivating the land. The back end of the frame is supported by a smaller running wheel, E, set upon a swivel centre, F, bolted to the framework, and capable of lateral adjustment thereon. The hauling gear or shafting, for steam or horse power, is fitted to the transverse bar, H, at the front end of the machine. A set of vertical holders or guide bars, L, are fitted at the back end of the machine to receive the slotted ends of the horizontal lever beams or bars, J, carrying the ploughshares or cultivators, A. The guide bars, I, are fitted at their lower ends into receiving holes formed in a horizontal supporting bar, which is bolted to the under side of the framing, and are secured at their upper extremities to the rectangular transverse bar, L, which is



bolted to the upper portion of the framing. The mode of securing the upper ends of the guide bars serves also to secure the segmental bars, M, which answer as guides to the lever handles, N. The upper ends of these segment pieces are slotted vertically and horizontally, the transverse holding bar, L, being passed through the horizontal slot, whilst the vertical guide bars, I, are passed through the vertical slot of the segment pieces, and the whole is firmly held together by a pinching screw in the back of the segment pieces, M. The front ends of the bars or lever beams, J, are fitted with fork pieces, or double eyes, by which they are jointed to blocks, P, the joint allowing the plough beams to rise or fall in the rear on meeting with any obstructions or great irregularity in the ground. The blocks, P, slide upon the set of vertical spindles, Q, corresponding to the guide bars, I. These spindles are formed with eyes at their lower extremities, fitting in between the fixed transverse bars, R, and secured therein by transverse pins. The upper ends of the spindles are fitted with collars, having short projecting studs formed upon them, and fitting into suitable slots in the front bar of the wrought-iron frame, W. The plough bars, or lever beams, J, are elevated by the front and back chains, X, attached to, and acting simultaneously on the ends of the bars. The after chains are left rather slacker than the front chains, so as to allow of a slight vertical play taking place in the back end of the plough beams. The chains pass respectively over the back and front set of loose pulleys, Y, the latter indicated by dotted lines. A short length of chain, Z, is attached at one end to each of the lever handles, N, and after passing over the back pulleys, Y, is connected to the back end of links, D, which are connected at their front ends to the front chains, X. The back chains, X, are attached to the chains, Z, close to the pulleys, Y, so that by drawing down any one of the lever handles, N, it will be obvious that both ends of the respective beam or bar, J, will be elevated simultaneously, thereby raising the ploughs, or other cultivating implements, from the ground, the beams being kept in a horizontal position. This lift may be limited, or the cultivating instruments retained at any desired elevation, by inserting a stop-pin at any desired part of the segment pieces, M. When the lever handles, N, are depressed to their fullest extent, they are retained in a hooked catch, formed for that purpose on the lower ends of the segments. A short handle, K, is fixed on to the back end of each of the beams, J, whereby the attendant may raise or depress the hind portions of each beam or bar individually, for the purpose of clearing the ploughs or cultivators from dirt when they are clogged, or for the purpose of more effectually entering them into the ground. Another handle, O, is also situated at the back of the machine, under the control of the attendant. This handle is fixed on the back end of the spindle or rod, S, which is fitted with a pinion at its opposite extremity. This pinion gears into a series of rack teeth formed on one end of the hind bar of the sliding wrought-iron frame, W, which works in slots in the plates, T, bolted to the outsides of the main framing. By turning the handle, O, in one direction or the other, a lateral traverse is given to the frame, W, by the attendant, thereby slightly inclining the vertical spindles, Q, and consequently giving a corresponding lateral inclination to the coulters of the ploughs, which will enable them to turn the furrows more efficiently when ploughing a hill side. During the operation of ploughing, the off-side front running wheel, C, runs in and is steadied by the furrow cut by the last previous traverse of the plough, whilst the corresponding wheel on the opposite or near side of the machine runs upon the unploughed ground. This involves the necessity of having the near side wheel higher by the depth of the furrow than the off-side wheel, and this raising or adjustment of the near side wheel may be effected either by a nut and screw, or by a pinion and rack, U. The lower end of the rack has an eye formed to receive the axle of the wheel, C. The axle is forged in one piece with a square boss, which slides vertically along a rectangular bar or rod fixed to the framing. On the axis of the spur-pinion is keyed a ratchet wheel, which is retained in position by a detent secured to the inside of the main framing. A square shank is formed on the end of the axis of the pinion, and an ordinary spanner is employed for turning the same when required for raising or lowering the running wheel, C. The ploughshares or cutters are set one behind the other as regards the direction of the plough's traverse, so that the off or right-hand plough or cutter begins to cut first, the second one next, and the near one last; and as the back-running wheel, E, follows immediately behind the newly-cut furrow on the near side of the plough, this wheel is thus guided by the last-formed furrow. The beams, J, have a slight upward bend formed in them behind their ploughs, in order to afford sufficient space for the turning over of the next furrow by the neighbouring plough in the frame. The framework may be greatly shortened and the machine lightened when using two ploughs in place of three; and it is proposed to adopt this arrangement in cases where the general nature of the ground is too heavy for a three-plough machine. In another modification of this machine, four ploughs are fitted into one frame in such a manner that two of the ploughs turn the furrow to the right and the other two to the left. In using this machine, two ploughs only are used at one time, the other two being elevated; and when the furrow is completed the machine is turned round, and the ploughs last in action are elevated, whilst the other two ploughs are let down and brought to work, thus enabling the machine to turn over two furrows both going and returning, the furrows, however, being all turned one way. This arrangement will not involve the necessity of having a longer frame than will be requisite for a machine with two ploughs, as the ploughs in the two sets of beams or bars will be opposite each other, although in each set one plough will be placed a short distance behind the other. Various kinds of cultivating implements may be fitted into the machine in place of the ploughs; and with suitable modifications of the details, the machine may be made to perform various kinds of agricultural operations besides that of ploughing.

PAPER SIZEING.

Dr. J. Macadam, *Glasgow.—Patent dated November* 17, 1854.

Dr. Macadam's system of preparing or sizeing paper is more particularly applicable in the manufacture of such kinds or qualities of paper as are partially or entirely "rosin-sized" and machine-made, and it consists in the partial or total substitution of aqueous solutions of the uncombined acids, or of aqueous solutions of single sulphates, or of other binary compounds, for the double sulphate of potash and alumina, known by the name of alum, usually employed according to the existing system of manufacture. The acids which are found to be best suited for this purpose are the mineral acids, especially sulphuric acid, such acids being employed in the diluted state with water, and in quantity sufficient for the neutralization of the whole, or a part, of the alkali of the resinous or rosin size which is used. The quantity or proportion of acidulous solution, when free acids are employed, is accurately determined by alkalimetrical processes; and such acids, or acidulous solutions, are added to the paper pulp either before or after the addition of the resinous size. In carrying out the invention, the aid of single sulphates, or other binary compounds in the form of aqueous solutions, and suited in quantity to the alkali present in the size, are used. Paper produced under this system of treatment is peculiarly suited for lithographers' purposes, as well as for the printing of engravings of all kinds, as it possesses an absorbent surface of a uniform character. It has also a less injurious effect upon the engraver's plates, and is well suited for letterpress printing, as it is readily susceptible of uniform damping, and affords clear impressions.

The following special materials and routine of treatment have been found most suitable for the effective working out of these improvements:—In the preparation of the resinous or rosin size, as ordinarily used, the resinous matter or rosin is dissolved, through the medium of water, by alkaline compounds, carbonate of soda, or carbonate of potash, for example. The solution thus prepared is that which is commonly used in the treatment or sizeing of printing paper, and the same solution is adopted when employing the improved process. For the sake of convenience and certainty, we shall uniformly term this solution the "size solution." When alum is added to such a solution, in contact with the paper pulp, decomposition of the "size solution" occurs; the acid of the alum neutralizes the alkali which is present, and the rosin is precipitated in contact with the fibrous matter of the paper pulp. In sizeing with rosin, the antiseptic influence of alum is not required, as in the case of sizeing paper by the agency of animal matters; or if at all necessary, it is so only within a very limited extent. The invention, therefore, essentially consists in the application and use of the free acids, or single sulphates, or other binary compounds, by the agency of which the desired neutralization of the alkali of the "size solution" is secured in a more economical manner, and with superior results as regards the quality of the paper, than when this chemical effect arises solely from the use of alum in the ordinary way. The agents named are employed to a greater or less extent, in accordance with actual circumstances, introducing at the same time more or less alum, as may be advisable. When single sulphates or other binary compounds are to be used to effect by their contained acid the neutralization of the alkali of the "size solution," such substances are applied in accurate atomic proportion for this end. The "size solution" is constantly prepared from the same proportions of rosin, water, and alkaline compounds, so that whether commercial carbonate of soda, carbonate of potash or soda ash, or other alkaline compound be used, the proportion of alkali in a given measure of the size solution may be as constant within such narrow limits as any fluctuations in the per centage of alkaline value of such compounds will admit. The strength of the acid aqueous solution is constant. Thus, taking sulphuric acid as an example—and this acid is preferred to others of the same class of compounds—it is employed as an aqueous solution, having the specific gravity of 1·100, or, in other terms, of 20 degrees by Twaddell's hydrometer. Whilst this strength is convenient for regulating and measuring the required quantities, still the degree of dilution is otherwise unimportant. It is advisable, however, to make this the minimum amount of dilution.

The required quantity of the dilute acid or acidulous solution is also regulated and adjusted thus:—The size solution being constant, or nearly so, in alkaline strength, and being used in definite and constant quantity for each class of paper, as sized in any particular engine of the papermaker's works, according to the capacity of such engine, a preliminary experiment is made to ascertain, by means of a graduated tube, divided into equal spaces, such as is usually employed in the estimation of the value of alkalies, what number of such graduated sections or spaces filled with the acid solution are necessary for the neutralization of a known proportion of the total amount of size solution as required for the pulp in any particular engine, in accordance with the special variety of paper being manufactured. The point of saturation is ascertained by stirring well the size solution on each successive addition of the acidulous solution, and until the size solution so treated slightly reddens litmus or other test papers. The quantity of acidulous solution being thus determined for a known proportion of the size solution, it is easy to ascertain, by calculation, the requisite amount for the whole of the size solution to be decomposed. But a more convenient system for practical purposes is, to have a series of measures capable of containing the requisite amounts of the acidulous solution to neutralize the alkali present in one, two, three, or other number of gallons of the size solution, so that the treatment is then reduced to an exceedingly simple form.

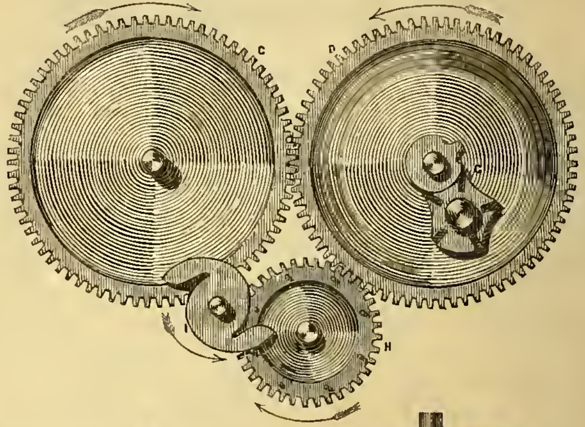
In the practical manufacture of paper, the following order or sequence of the applied substances or treatment is found to be the best, although the order may be varied more or less:—The paper pulp being introduced into the sizeing engine, with the customary quantity of water, the necessary or determined quantity of size solution is added, and at an interval of about twenty minutes, more or less, the engine being meanwhile in action, the determined quantity of acidulous solution is introduced. At the expiration of about twenty minutes more, more or less, and when the neutralization is complete, and the deposition of the rosin thus economically accomplished, any alum which is to be applied is added. This substance, for ordinary printing papers, is commonly added in the proportion of about two pounds weight to each hundredweight of the pulp necessary for the manufacture of paper. This proportion varies, however, according to the required hardness of the surface of the paper, this hardening effect being the chief result due to the introduction of alum in the improved process. In some kinds of paper, alum may be entirely dispensed with in working out this process. This dispensing with alum applies more particularly to paper used by lithographers and engravers, for whose work alum is known to be prejudicial. After the addition of the materials to the pulp has taken place in the hereinbefore described order, the usual colouring matter is applied, and at this stage, also, any fine clay or other material with which it may be desired to impregnate the paper.

UNIFORM SPRING MOVEMENT FOR TIMEKEEPERS.

J. V. Weber, *London.—Patent dated November* 28, 1854.

This exceedingly ingenious contrivance is designed to supersede the fusee and chain movement ordinarily employed in clocks, watches, and chronometers driven by the reaction of springs, its object being to obtain a uniform pressure on the going works of the timekeeper during the whole time between the periods of winding up the spring. As an ordinary watch spring runs down, its power gradually diminishes, and in the fusee movement this is compensated for by making the transmission of the power take place with a continually increasing leverage. In Mr. Weber's arrangement, however, the works are acted upon by means of a spring which is kept constantly at the same degree of pressure. It may seem paradoxical how a spring can move machinery and still be maintained at the same tension, but this is effected in a very simple way by the mechanism represented in our engravings. Fig. 1 is a face view or elevation of the details composing the improved driving movement, and fig. 2 is an edge view or plan corresponding. The works of the timekeeper are connected to and driven by the spur wheel, A, which is fixed on the barrel, B, and is itself actuated by a spring contained within the barrel. This spring is fixed in the ordinary way, namely, with one end fast to the barrel, whilst the other end is fast to the spindle upon which the barrel, B, and wheel, A, are loose, and can revolve. The spindle upon which the inner end of the spring, B, is fixed, has also fast on it a spur wheel, C, which is in gear with a spur wheel, D, fast on the barrel, E, of a stronger spring. The spindle of this spring has upon it the ratchet wheel and detent, F, and the catch wheels, G, by which the winding up is regulated. The spur wheel, D, is also in gear with a pin wheel, H, having in this instance eight pins upon its face. These pins turn in concert with a double volute wheel, I, which is fast on a spindle carrying a pinion on its opposite end, in gear with the wheel, A. The proportions of the wheels are such that the volute wheel, I, will make four turns for each turn of the wheel, H. In first setting this mechanism, the spring, E, is wound up until it winds up the spring, B, to the desired working tension. The spring, E, acts on the spindle of the spring, B, by means of the wheels, D, C, and the two springs will be in equilibrium as long as they are free to act on each other. The wheels, H and I, are then put in their places, and the spring, B, is wound up to its limit. When so wound up, the volute wheel, I, prevents the spring,

Fig. 1.



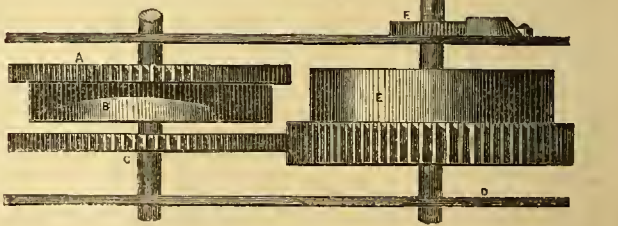
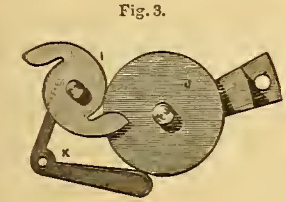


Fig. 2.

E, from acting any farther on the spring, B, as the pins on the wheel, H, act in a direction almost directly towards the centre of the volute wheel, I. The spring, B, however, is free to act upon and drive the works of the timekeeper by means of the wheel, A; but in so doing, this wheel, A, turns the volute wheel, I, so as to allow the wheel, H, to turn as the spring, E, is constantly tending to drive it. This motion of the wheel, H, again, allows the spring, E, to act on the spindle of the spring, B, and the curve of the volute wheel, I, is so calculated, that the amount of turn given to the spindle of the spring, B, will be exactly equal to the amount of turn made by the wheel, A, so that the spring, B, will be maintained at a uniform tension as long as the spring, E, has power to act upon it, notwithstanding that the wheel, A, is constantly turning and driving the works of the timekeeper. Amongst other advantages, the arrangement possesses that of having in itself a superior maintaining power, which keeps the timekeeper going accurately during the time the spring is being wound up; for it is obvious that the winding up of the spring, E, cannot affect the tension of the spring, B, during the longest time the action of winding up can occupy. The pins in the wheel, H, are moveable, and when each pin reaches the inner end of the volute of the wheel, I, it recedes, and allows the other tail of the latter wheel to pass over it. The movements of the pin are regulated by a spring contrivance, which is represented in fig. 3. This consists of a spring disc, J, fixed to the framing of the timekeeper, and having a central aperture through which the spindle of the wheel, H, passes. This disc, J, is shaped so as to press each pin forward as it comes into a position to act upon the wheel, I, and to allow it to recede when one of the tails of this wheel has to pass over it. The spindle of the wheel, I, has a slight play in slotted bearings, and is acted upon by one arm of a bell-crank lever, K, the other arm of which is bevilled so as to act on the spring disc, J. By this means the pressure on the spindle of the wheel, I, is much relieved, as it tends to force one arm of the lever, K, against the disc, J, and to lift the wheel, H, against its upper bearing. The variations in the action of the spring, arising from change of temperature, may be compensated for by making the lever, K, of a combination of metals, such as steel and brass, which are unequally acted upon by changes of temperature.

Fig. 3.



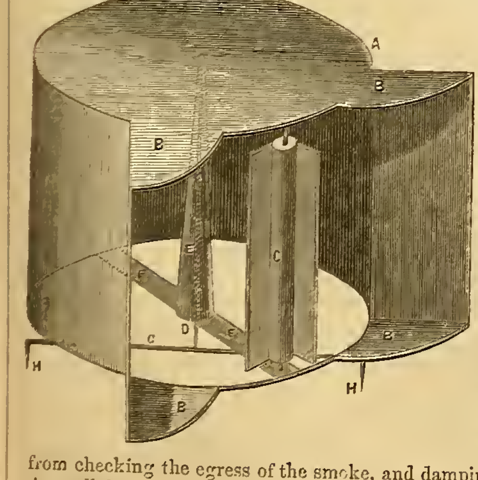
Instead of the volute and pin wheel contrivance, a worm and worm wheel may be adopted; and in large chronometers, where the utmost degree of accuracy is desirable, a chain and fusee may be interposed between the spring barrel, E, and the wheel, D.

REGISTERED DESIGN.

SMOKE PREVENTOR.

Registered for the Rev. J. Burrow, *Ashford Parsonage, Bakewell, May* 22, 1855.

The subject of this registration is a revolving chimney hood or cap, designed to improve the draught, and to act as a protection from the action of the wind, and thereby to avoid the evil of a smoky chimney.



The annexed figure represents the improved "smoke preventor" in perspective. The circular hood or cap, A, composed of any suitable sheet metal, is fitted or formed with two projecting ears, B, B, which, from the action of the wind, causes it to revolve, and present its circular closed side always to the wind, and likewise prevent the currents of air from checking the egress of the smoke, and damping down the chimney. A small fan, C, rotated by the action of the smoke is fitted in the mouth or opening of the smoke preventor, and by its motion stimulates the ascension of the smoke. The whole apparatus is supported by and turns on the fixed vertical spindle, D, which is inserted inside the cone, E, fast to the bar, F, soldered or otherwise secured across the lower mouth of the smoke preventor. The spindle, D, is in one piece with the cross bar, G, which is formed with spikes at H, to be built in with the brickwork of the chimney, or the spikes may be made to embrace the edge or lip of an ordinary chimney pan or pot, if the smoke preventor is to be applied thereto.

REVIEWS OF NEW BOOKS.

Opposition to Great Inventions and Discoveries: A Lecture by the Rev. Samuel Martin. Pp. 40.

The Dignity of Labour: A Lecture by the Rev. Newman Hall, B.A. Pp. 48. London: J. Nisbet & Co. 1855.

The excellence of the subjects and the felicity of the titles of these two little books have casually attracted our attention to the more recent of the lectures, delivered by various clergymen before the "Young Men's Christian Association," in Exeter Hall, of which series these two discourses form a part. "What many have vainly wished the stage to be," says the preface to the last volume, "the platform may become—the supplement to the pulpit and the auxiliary of virtue." That the present scheme of instruction is well conceived, and is being soundly and solidly carried out, we are now prepared to show, if indeed the very copious transfers which we made to our May Part from these two very prints, have not already given indications in this way. The committee of the association have done the world good service in laying before it pamphlet copies of their lectures in the accessible form in which we have found the two now noted as our textual matter. Reversing the order of the original title, the Rev. Samuel Martin, in his excellent discourse, takes us first to "discovery," pointing out very properly, as we have done before him, the essential difference between discovery and invention. Discovery tells us what exists, of which we knew not; invention gives us something wholly new to the earth and its inhabitants. But a curious instance of a total and utter confounding of name and meaning, even in the face of the essential difference now so well acknowledged, exists where least of all such error should have arisen, unless to afford a hold for parties of inimical religious views. This is in the ritual of the Romish Church, where there actually appears the heading "The *Invention* of the Holy Cross." "The discoverer," in the emphatic words of our present author, "leads us to knowledge—the inventor puts into our hands a power;—the former reveals to us that which is—the latter provides us with that which has not been; the one is to society as the eye in the human body, and the other is as the hand."

Discovery and invention sometimes, but rarely, exist in one and the same individual; and we naturally recur to Galileo as an apt example of this peculiar combination of qualities. But this is the exception to the great rule, which, in our own pages, has already received elaborate argumentative treatment. All the world knows the story of this early philosopher's difficulties in the way of stubborn opposition to his great discovery settling the then great question, whether the sun or the earth was the moving body; and this leaf from the history of the ancients very properly affords an important link in this chain of discourse upon the "opposition to great inventions and discoveries."

But the lecture before us takes us much farther back than this—even to the burning of the works of Protagoras, the Athenian, who was in the zenith of his fame about four centuries and a half before Christ. Roger Bacon is a more pointed and homely example:—

> "Roger Bacon was forbidden to lecture; his writings were prohibited; and when sixty-four years of age he was imprisoned in his cell, and kept in close confinement for ten years; his offences being that he understood perspective, the use of convex and concave glasses, the camera obscura, burning glasses, and was in advance of all Englishmen in his acquaintance with science in general. This morning star retained its brightness behind the cloud which for a time concealed it; and the dawn which it harbingered duly came. The opening of the sixteenth century was the fullness of the time."

The names of Copernicus, Tycho Brahe, Kepler, Torricelli, Newton—whose discoveries were even snubbed and ignored by his own university—Columbus, Harvey, and Jenner, take us down the current of time to days nearly approaching our own with rich examples of what obstinate prejudice and abstract hostility to the man or his reasoning have brought upon the world. Nor is it to be overlooked, that so lately as 1837 there appeared a work, entitled "Popular Geology Subversive of Divine Revelation," denouncing the "new science of geology," and asserting, in strong terms, by no means uncommon at the present hour, that this great science was at once the enemy of God and man. When we turn to invention, we find that so much of invention as may be said to be involved in the application of coal as a fuel, was vehemently repelled in the beginning of the fourteenth century, when Edward II. granted the prayer of a parliamentary petition to forbid the use of this invaluable mineral, which was denounced as a great public nuisance. The invention of printing, although choked by opposing difficulties of various kinds, incurred less injury from opposers than we now think it could have done, had the giant powers of its maturity been in any way forseen. Even this simple contrivance was credited to the labours of unearthly powers. Turkey, the capital itself, could not boast of a single press for three hundred years after the existence of the art elsewhere; and at the present day, although some progress has certainly been made, printing, as a profession, does not yet exist in the Turkish dominions. In classing De Caus and the Marquis of Worcester amongst the neglected inventors of the steam-engine, the lecturer has been led into a too common error, which we endeavoured to combat in our leading article of last month. We could not admit these men into the list where Mr. Martin has placed them, without opening the door for the entry of numberless schemers whose aims were visionary and baseless, and whose fates were not unreasonably obscure and unlamented.

The mechanical many-threaded spinner, the power-loom, gas, macadamised roads, steam navigation, and railways, have all undergone that ordeal through which even the most obvious improvements, under the most promising circumstances, have invariably had to pass. Whilst we write, we see for ourselves that the tide of invention is by no means smooth. On the contrary, it has in its course countless obstacles against which it first impetuously rushes, and then recoils to worm its way by some more noiseless route.

In tracing the causes of human opposition of this nature, the author leads off with ignorance and prejudice, but includes a long range of other stumbling-blocks, which are, in reality, but offshoots and branches from these two rudely-gnarled stems. It would require but little reasoning to show that these two vices—for vices they are in their every effect—have been at the root of every fallen tree which bore upon its branches either the blossom or the fruit of discovery or invention. The preacher, with a generous and benevolent eye, looks upwards and says—"Instead of chaining the discoverer, God gives him wings; and instead of tormenting the inventor, God ultimately crowns him with honour."

In this industrial age, the "dignity of labour" is a sermon which is thundered down upon us from every haunt of man. "Labour is the great law of the universe. Every atom and every world alike proclaim it. It is whispered by every breeze, and reflected from every star.' But its wide-spread teachings sink not deeply into the hearts of inattentive listeners. Both employer and employed—he who plies the hammer and who drives the plough, and he who passively inherits his father's gold—are but too slow to recognise the great truths on which our second author has built his discourse:—

> "Emphatically," he says, "is labour the law of humanity. The structure of our body, as a whole, and of every separate organ in it, shows that we were designed for activity. Who can study the formation of the foot, but must be convinced that it was made for motion; or of the hand, without the certainty that it was contrived for toil? Why was the ear so skilfully constructed for the conveyance of sound, but that it might listen; and why was the eye placed aloft, but that, as a watchful sentinel, it might faithfully guard the citadel, and promptly report all outward things to the busy spirit which sits enthroned within?
>
> "On their exercise the vigour of all our faculties depends. Health cannot breathe the atmosphere of sloth. Power will not obey the voice of the sluggard, nor develop itself except in the gymnasium of toil. The muscle shrinks which is never strung, the joint stiffens which is never moved, the limb becomes powerless which is never taxed. The rust of indolence corrodes and destroys, as well as defaces, whatever it is allowed to gather on. So with the mind. Its faculties of perception, and memory, and reflection, and imagination, must be exercised if they are to be vigorous. The soul will never come forth as a strong man completely armed for victorious conflict, if summoned merely by indolence to strut on the lazy parade ground of vanity. On the contrary, every natural endowment will shrivel up which is not called out to labour, and the scripture will be verified which says, 'From him which hath not, shall be taken away even that which he hath.' Thus man's moral nature, as well as his intellectual, is destroyed, and that which was designed to be an immortal temple for Deity to dwell in, becomes a melancholy ruin. The conscience eventually ceases to speak when it ceases to be consulted—ceases to command when it ceases to be obeyed. Holy impulses no longer urge the man who permits activity only to his lusts. The still small voice of lingering Deity will speak in fainter and yet fainter whispers from the inner sanctuary, until it finally ceases to counsel and to warn the man who will not rouse himself to listen, and whose fatal lethargy nothing then will dispel, until the trumpet blast of doom shall startle him into the wakefulness of despair."

The hunger of the patiently industrious, is it not the keenest of sauces? And do we not value our toil-won possessions by a standard the most elevated and refined of all? And no matter whether the labour is that of the head or the hand, the brain or the muscles, the law is alike undeviating.

> "We have the Historian deducing from the experience of the past directions for the present, and hopes for the future: the Philosopher, pondering the deep mysteries of being, and revealing the secret springs of thought and volition: the Man of Science, now hammering from the rocks of the earth the long-buried secret of her past existence, now weighing the sun and measuring the sky, and foretelling the motions of the planets, and calculating the distance of the stars; at one time ranging the universe to explore its mighty plan, at another minutely examining the tiniest atoms, and subjecting the subtlest elements to the scrutiny of his severe analysis: the Painter and the Sculptor, making the bare canvas and the shapeless marble breathe with life and glow with feeling, and by these delineations of nature, or the embodiment of their own lovely dreams, elevating the taste of all who behold: the Poet and the Orator, causing the inmost chords of sympathy to vibrate, by the fit utterance of noble thoughts, and rearing a monument more enduring than marble and brass, whereby to commemorate deeds of heroic goodness for the homage and imitation of posterity."

One paragraph more from this eloquent appeal, and we shall have urged all that can be necessary to induce a perusal of its pages, and a calm contemplation of the ideas which they must develop.

> "I would take you to the dingy office, where day by day the pen plies its weary task, or to the retail shop, where from early morn till half the world have sunk to sleep, toilsome attendance, with scarce an interval for food, and none for thought, is given to distribute the necessities and luxuries of life:—I would descend further,—I would take you to the ploughman plodding along his furrows; to the mechanic throwing the swift shuttle, or tending the busy wheels; to the miner groping his darksome way in the deep caverns of the earth; to the man of the needle or the trowel, the hammer or the forge; and if, while he diligently prosecutes his humble toil, he looks up with a submissive, grateful, loving eye to Heaven,—if in what he does he recognises his Master in the Eternal God, and expects his wages from on high,—if, while thus labouring on earth, anticipating the rest of heaven, he can say, as did a poor man, who, when commiserated on account of his humble lot, said, taking off his hat, 'Sir, I am the son of a king, I am a child of God, and when I die, angels will carry me from this Union Workhouse direct to the court of heaven,'—oh, when I have shown you such a spectacle, I will ask—Is there not *also* Dignity in Toil?"

COMTE'S PHILOSOPHY OF THE SCIENCES: being an Exposition of the Principles of the Cours de Philosophie Positive of Auguste Comte. By G. H. Lewes. Bohn, 1853.

THE POSITIVE PHILOSOPHY OF AUGUSTE COMTE, freely translated and condensed. By Harriet Martineau. Two Vols. John Chapman, 1853.

It may probably be in the recollection of some of our readers, that a year or two ago we laid before them some chapters relating to the mathematical sciences, translated from Comte's great work. We rejoice to see that the public has now an opportunity of taking a bird's-eye view of the whole work, and we trust that the result will be soon apparent in the better education of the public mind. We say a *bird's-eye* view, for though Miss Martineau's translation fills two tolerably bulky volumes, the original work fills six—each containing, on an average, eight hundred pages. In point of fact, it is not to be denied, that Comte is not only a luminous but a voluminous writer, and we think it is well that he should make his first appearance amongst us in a condensed shape. There is, moreover, another reason why a condensation is to be preferred to a full translation. The first volume of the 'Cours de Philosophie Positive' appeared as far back as 1830, and the last not more recently than 1840. Now, though it is true that the work treats of the philosophy of the sciences, and not of their special phenomena, yet the author could only deal with the sciences as he found them, and his illustrations would necessarily be taken from them as they stood at the time of the publication of the book. Since that time, however, the physical sciences have made great advances, and that part of the work which treats of them has, consequently, a somewhat antiquated air. But by giving us a free condensation or an exposition of the book, this defect is repaired, and we see the work, in Miss Martineau's free translation, pretty much as Comte would have written it, if he had composed it now instead of several years ago, and if he had composed it solely with a view to readers, and not in the shape of lectures. Iteration and expansion are not only allowable before an audience, but, where the matter is at all abstruse, they are indispensable. A reader, however, is in a different position from an auditor, and he soon charges a book with tediousness when iteration and expansion are carried beyond certain limits. Hence it is better that we should have, at all events at first, an abridgment rather than a complete literal translation.

Of the two works before us, Mr. Lewes' is much more in the nature of a commentary than Miss Martineau's. He terms it an Exposition of the principles of Comte's book. It does not contain much more than a sixth of the matter of his fellow-labourer's two volumes, and yet it departs more widely from the original, and sallies out farther into the field of modern science, than Miss Martineau has thought herself entitled to do. There is, consequently, sufficient difference between the two books to render each desirable as a popular rendering of Comte. Mr. Lewes' volume is a suitable companion to his 'Biographical History of Philosophy,' to which clever work it is a fitting sequel. He is an agreeable guide along paths which many people are deterred from attempting by their threatening to lead them through an uninteresting country covered with interminable obscurity. We do not mean to say that he can lend to philosophy the amusement of a novel, but we have no hesitation in declaring that he can render our progress very pleasant, and can lighten our labours very considerably by his company and assistance.

That Comte's sweep is wide and his aim lofty will be understood when we state, that he proposes in this work—1°, To expound the only true classification of all the subjects of human thought and inquiry, so far as they are realities and bear upon the advancement of man, and to show how this exposition bears upon the momentous question of education; 2°, To point out the true method of all scientific investigation with the view of advancing our knowledge of nature; 3°, To show the true method of investigating the laws which regulate society; to apply right principles to the study of human and social phenomena, with the view of improving man's position in the world. That part of the work which relates to the physical sciences will be most readily understood and most generally appreciated.

It is a fundamental position of Comte's method, that in all our scientific investigations we have nothing to do with the causes of phenomena, but only with the study of their laws, that is, their invariable relations of succession and resemblance. For example, in the study of rational or theoretical mechanics, the causes or modes of production of motion are beyond the pale of inquiry, and we must confine ourselves to the motion itself. He utterly condemns that tendency to look for the essences of things instead of studying concrete facts, which has infected every department of science except mathematics, up to the present hour.

As regards the often debated subject of the classification of the sciences, the problem before him was their arrangement, in such a way that the classification should itself express the most general fact to be derived from an investigation of the objects classified. It is evident that the relations of any one science to any other, will depend upon the relations of the phenomena of that science to the phenomena of the other, and, consequently, that classification alone can be the true one which places the sciences in the order of the generality of the phenomena. The science which deals with phenomena that are more simple and general, must stand before that of which the phenomena are more complex and special. The reason is evident—those phenomena ought to be studied first which do not depend upon, and are not entangled with, phenomena having more complex relations. Hence mathematics, which deal with the simplest of all phenomena—those relating to space and number—form the base of Comte's classification. Rational mechanics are but a branch of mathematical science, having for their basis certain generalized facts, termed Laws of Motion. Next comes Astronomy, having for its object the discovery of the laws of the geometrical and mechanical phenomena presented to us by celestial bodies. Astronomy owes nothing to Physics, Chemistry, or Physiology, whilst no terrestrial science can be perfectly studied except it requires only a knowledge of mathematics through astronomy. Hence the study of it ought to precede that of all the sciences except mathematical science. Pursuing the same line of reasoning, we arrive at Physics, as the science which ought to be taken before Chemistry or Physiology, because its phenomena are less complicated than theirs. The theses of astronomy afford the only data for the study of terrestrial physics, and the relative position of the two sciences is thereby distinctly determined. It is to be remarked, that mathematical analysis can be applied to the investigation of the phenomena of physics, but cannot at present be carried any further. There is enough of simplicity and fixedness in physical phenomena to allow of the extensive use of mathematics (a notable example being 'Fourier's Labours in Thermology'), but the nature of chemical phenomena does not allow of any application of mathematical analysis, though there can be no doubt that the study of chemistry would be greatly advanced were the minds of its cultivators trained by the previous study of mathematics. The evil effects of the absence of the mathematical spirit and discipline, is daily brought to light in the proceedings of chemists. The principles of chemistry having been mastered, we reach a totally distinct order of phenomena. In the phenomena previously studied, inanimate matter was the subject of our inquiries; but now the complicated phenomena of life become mixed up with the former. In this division of science, the first branch is Physiology, dealing with the individual only, whether vegetable or animal, and the second, Sociology, in which, leaving behind vegetables and irrational animals, we study the phenomena of humanity in a state of association. The science of Social Physics is yet quite in its infancy, and even its foundations had not been laid until Comte undertook the task. Thus, with mathematics as the basis, we have five fundamental sciences in successive dependence, namely, Astronomy, Physics, Chemistry, Physiology, and Social Physics or Sociology. In the first, we deal with the most general, simple, abstract, and remote phenomena with which we are acquainted; in the last, we consider phenomena which are the most special, compound, and concrete, and withal the most interesting to man. The principles of society are here investigated and expounded; the path it ought to take, and which it will sooner or later take, is pointed out; a new light is held before History, Political Economy, and all the sciences relating to social phenomena, and the true interpretation of man's position amidst material things is given to us.

This question of classification must not be deemed a merely curious problem, well enough as an exercise of the intellect, like a game at chess, but having no interest or value beyond this. As Comte has treated the matter, it is seen to have a direct bearing upon the very important subject of education, inasmuch as it points out the order and method in and after which the mind should study the sciences with a view to its most perfect development. To the absence of a system of rational scientific education amongst us, may be attributed much of the imperfection of several of the most important sciences at the present day, and the development of the sciences will be more or less rapid as the system founded upon this classification is more or less adopted. The same remark is, of course, applicable to a system of general education; for, by following the method which flows naturally from this classification, not only will much time be saved, but the mind will be trained to associate early with truths, not with misleading hypotheses. The reasoning powers will be systematically educated from the first, and surely no one will deny that whatever improves the reasoning powers of a nation, influences for good the whole life of that nation—nay, more, the future of the world. The more the phenomena of the universe are considered from a truly scientific point of view, the more the connection of the sciences with each other, and the interdependence of the special phenomena of each are seen brought into light; the more the true principles of scientific investigation are pursued, the greater will be the progress of civilization, which we take to be the simultaneous advance of a people in knowledge and happiness.

Our estimate of Comte's work may be gathered from the length of our notice. We consider it one of the most valuable aids to social progress ever presented to the world in the shape of a book, and hope that the translations under review will be widely read and rightly appreciated.

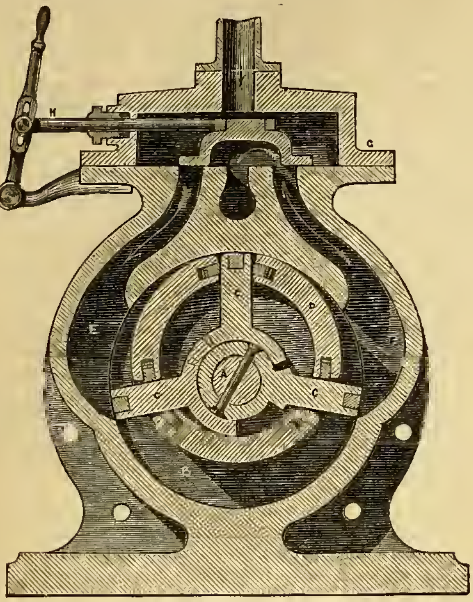
Elementary Physics; an Introduction to the Study of Natural Philosophy. By Robert Hunt. London: H. G. Bohn.

Mr. Bohn will seriously compromise the credit of his Libraries if he allows such books as this and Devey's Logic to appear in them. Against the latter work we have already warned our readers, and we must take the same course with regard to Hunt's Elementary Physics. The book is full of mistakes from beginning to end. It is hardly too much to say that every page has something erroneous upon it. How the author can have contrived to obtain either his position in the scientific world, or his appointment at our National Museum of Geology, must be a matter of surprise to any one who will take the trouble to examine this book. It is our duty, as reviewers, to inform students that they will not only find the propositions of this work unintelligible, but in very many passages, where they are comprehensible, the statements are at variance with the facts of nature. Whether Mr. Hunt's opinion, that "it is quite possible to render every truth intelligible by the most simple language," be rightly or wrongly founded, he certainly has not succeeded, in this volume, in proving its correctness; and the declaration of his intention "to give accurate information on every important fact connected with physics, and to explain the experimental evidence by which each law has been developed," cannot but provoke a smile at his combined presumption and incapacity. The work appeared some time ago, but this is stated to be a new edition, with corrections. It is right to explain that it is the old book (not a reprint), with some of the leaves, where there were very glaring errors, removed, and new ones inserted.

CORRESPONDENCE.

JONES' ROTATORY ENGINE.

The accompanying figure is a vertical section of a rotatory engine, invented by me some years ago. The first motion shaft, A, is passed through the centre of a cylindrical chamber, B, and carries three pistons, C, which fit the cylinder, A, radially. One of the pistons, C, is pinned upon the shaft, A, but the other two are susceptible of a slight play round it. All three pistons pass through slots in a cylinder, D, disposed eccentrically to the chamber, B, so as to be in contact with the upper part of it. The cylinder, D, revolves in grooves in the ends of the chamber, B, and, as the pistons revolve, is carried round by them, whilst they each alternately project from, and are drawn within it. The steam enters by a side passage, E, and is exhausted through a similar passage, F, on the opposite side. These passages, E and F, communicate with a valve chamber, G, in which is a common slide valve worked by a lever and rod, H. The engine turns in either direction, according as the valve is set to one side or the other. The steam acts on the piston which projects from the cylinder, D, and by the time one piston reaches the exhaust passage, another piston comes forward to supply its place, and in this manner the motion is rendered continuous. The slots in the cylinder, D, are fitted with metallic packing slips, as are also the outer ends of the pistons, C. I have made a small engine of this kind which works very well.

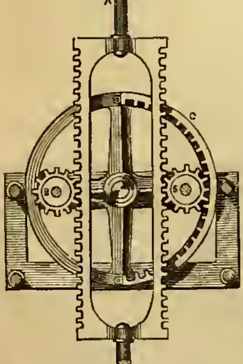


Glasgow, June, 1855. J. JONES.

MOVEMENT FOR THE CONVERSION OF RECTILINEAR INTO CIRCULAR ACTION.

The accompanying sketch represents a contrivance for effecting the often required end of converting reciprocatory into circular motion. The longitudinally traversing rod, A, which may be the piston-rod of a steam-engine, for example, being properly guided to insure its following a straight path, carries a double-sided toothed rack, each range of the teeth gearing with one of the two toothed pinions, B. These pinions are duplicates, and they run loose on stud-spindles in a fixed frame, and both come within the range of the half circle of teeth on the wheel, C, which is fast on the horizontal shaft, answering to the crank shaft of the engine.

In the sketch, the rack is supposed to be at half stroke, and the right-hand rack and pinion are in positive action, the pinion on that side being in gear with the toothed segment, C. The onward traverse of the rack obviously causes the revolution of the wheel, C, this revolution being continued by the right-hand side action, until the segment of the wheel, C, escapes from the action of its pinion. This occurs just as the rack arrives at the termination of its stroke, at which time the forward end of the segment reaches, and enters into gear with, the pinion on the opposite side. The return traverse of the rack then takes up the movement, and carries forward the wheel, C, for another half turn, and so on.



The arrangement is modifiable in several ways. For example, the wheel, C, may be made bevil, or with crown teeth, into which two pinions, carried on a vertical shaft in the place of the rack, are made to gear. If this shaft is the continuous mover, the segmental wheel shaft will obviously have a reciprocatory action, the reverse being the case if the segmental wheel is the driver.

I think the arrangements might be turned to good account by adapting them to planing and winding machines.

Edinburgh, May, 1855. W. BAIN.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

SOCIETY OF ARTS.

MAY 9.

"On the Manufacture of Steel as carried on in this and other countries," by Mr. Charles Sanderson. After alluding to the great antiquity of this manufacture, and to the fact that the quality of the iron from which it is made is of the first importance, the author proceeded to state that the mines of Danemora had long enjoyed the highest reputation for producing iron of the finest description for steel purposes. Sweden also produced a large quantity of iron suitable for steel, but not of equal quality to that from the Danemora mines. It was obtained almost entirely from the black oxides, and was manufactured in badly-constructed works. Recently, however, some of the Swedish works have introduced our English charcoal refineries, and our mode of working, by which a sounder iron is obtained, and one freer from adventitious matter. At present we are largely indebted to Sweden for our supply of suitable iron for the manufacture of steel. The average annual importation from that country during the last ten years has amounted to about 26,000 tons. If to this be added that imported from Russia and that made in this country, the annual make of steel must now amount to from 40,000 to 50,000 tons, of which not less than 15,000 tons are annually consumed in Sheffield for springs and common hardware. The weight of cast-steel annually manufactured in this country cannot be exactly ascertained, but it may be estimated at from 25,000 to 30,000 tons. In England the fuel used is entirely coal and coke. Coal is used in the converting furnace for heating the cases which contain the bar-iron during its process of cementation. Coke is used in the melting process, the consumption being on an average 65 cwt. per ton of ingots. The total annual consumption of coal in this branch of trade may therefore be taken at 125,000 tons. In Germany, France, and Austria, with trifling exceptions, steel is produced in a furnace similar to the charcoal refinery, about 240 bushels of that material producing about one ton of raw steel. Having given an estimate of the raw materials used in the manufacture, the author next proceeded to describe the different kinds of steel, and the processes pursued in various countries. Steel may be divided into two great classes—that in which the carbon is derived from the metal itself, and that in which carbon is introduced into the metal. Of the former class we have, first, natural raw or German steel, manufactured from crude iron as obtained from the blast furnace; second, puddled steel, a very recent invention, and the manufacture of which is entirely confined to Westphalia; and third, Paal steel, produced in Styria by a peculiar process based upon the old one of Vanaccio, and which consists in plunging iron into a bath of melted metal. Of the latter class we have, first, cemented or converted steel, produced by the carbonization of wrought-iron; and second, cast-steel, obtained by the fusion of either natural or cemented steel, but principally the latter. The furnaces in which raw or natural steel is manufactured are nearly the same, as far as regards their general construction, in all countries where such steel is produced; yet each country, or even district, has the fire in which the metal is worked differently made. The furnace is built in the same form as a common charcoal refinery. The fire is 24 inches square in plan, and 16 inches deep. There is first a bottom of charcoal rammed down very hard, then another bottom not so closely beaten down, which protects the under one, and serves to give out carbon to the loop of steel during its production. A thin stratum of metal, which is kept in the fire to surround the loop, immediately succeeds, and then the loop itself. Good workmen make 7 cwt. of steel in seventeen hours, and the waste of pig-iron is from 20 to 25 per cent. In the manufacture of puddled steel, about 280 lbs. of pig-iron are charged into a puddling furnace. As soon as this metal begins to melt, the damper is partly closed, and 12 to 16 shovelfuls of cinders, &c., are thrown into the furnace; the whole is then melted down together, and puddled with great care. The metal having become so far decarbonized, the damper is opened, and 40 lbs. of pig-iron charged near the firebridge of the furnace. This is allowed gradually to melt and mix itself with the metal previously charged, which causes it to boil; a blue flame rises from the surface of the mass, and very shortly the metal stiffens. The damper is again three quarters shut, and the mass is worked till it becomes waxy. The metal is then collected into balls and hammered into blooms. The furnace for converting iron into steel by cementation, consists simply of two troughs, built of firebrick, 12 feet long, 3 feet wide, and 3 feet deep; the fire-room is placed between them, and the whole covered by an arched vault, so that the heat may pass around these troughs, and distribute itself equally. The first steel, which may be called cast-steel, is the celebrated wootz of India. It is produced by mixing rich iron ore with charcoal in small cups or crucibles. These are placed in a furnace, and a high heat is given by a blast. The melting of bar-steel was first practically carried out by Mr. Huntsman of Attercliffe, near Sheffield. The manufacture of cast-steel is very simple. Bar-steel, broken into small pieces, is placed in a crucible, and is melted in a furnace about 18 inches square and 3 inches deep. The crucible is placed on the grate-bars of the furnace. Coke is used as fuel, and an intense heat is obtained. Yet it requires three and a half hours to perfectly melt 30 lbs. of bar-steel. When the steel is completely fluid, the crucible is drawn from the furnace, and the steel is poured into a cast-iron mould. The result is an ingot of steel, which is subsequently heated and hammered or rolled, according to the want of the manufacturers. In conclusion, the author contrasted the steel manufacture of England with that of America and the continent of Europe. He first gave an estimate of the weight of steel manufactured in each country, and its value as an article of commerce; and secondly, showed that England produces a larger quantity than the whole continent of Europe and America.

May 16.

The Right Hon. the Earl of Hardwicke in the Chair.

On the walls were suspended a series of twenty photographic views of the building in which the Industrial Exhibition was held at Munich, last year, presented to the Society by direction of the Earl of Clarendon, and on the table was exhibited, by Messrs. Appleton, a new bed or mattrass for the use of the army and navy, as well as for emigrants and travellers. It weighs only 4¾ lbs., and when folded up is 2 feet long, and about 7 inches in diameter. When spread open it is 6 feet long and 2 feet broad. It consists of an outer or lower covering of waterproof material, and an inner lining non-waterproof. Between the two there are corrugations, 1¾ inches broad, filled with ground or pulverized cork, which does not "mat" or "felt," preserves the body from damp, retains the heat, has sanitary and purifying qualities, and no insect can live therein. The mattrass ought to be used, under some circumstances, for pontoons or floats, and a single one has sufficient buoyancy to support the heaviest man.

The paper read was on "The Capability for Mercantile Transport Service of Steam-Ships," by Mr. Charles Atherton.

The object of this paper was to suggest and exemplify some definite process of investigation and arithmetical deduction, whereby the capabilities for sea transport service of steam-ships might be as correctly estimated as was the capability for land transport service of the railway locomotive engine. Railway capability had already been reduced to a definite process of calculation, while steam-ship capability had never yet been subjected to arithmetical reduction, simply because the very terms, "tonnage" and "horse-power," by which the elementary details of steam-ship service are designated, are absolutely indefinite. No legislative enactment had hitherto defined the standard unit of quantity that was meant by the tonnage of a ship, as denoting the measure of a ship's capability for transport service, either as respects measurement or weight, or what was meant by "nominal horse-power" as the standard unit of the measure of the amount of force which a marine engine might be legally required to be capable of exciting. Nevertheless, ship's *tonnage* and marine engine *horse-power* are under the nominal base of mercantile pecuniary contracts to the extent of millions per annum. For example, in the Government transport service for the past year (1854), the amount of shipping employed had been designated as about 210,000 tons tonnage and 26,000 horse-power, involving pecuniary contracts based on the indefinite terms tonnage and horse-power to the amount of £3,000,000 sterling. In fact it might be plainly asserted, that a contract for the building or hireing of ships, based simply on the nominal tonnage of the ship and the nominal horse-power of the engines, bound the contracting parties as to the sum of money that was to be paid, without affording any definite or specific guarantee whatever as to the amount of capability for service that the vessels so purchased or hired would afford. The following points were severally examined and presented for consideration:—The tonnage and displacement, and their mutual relations; the nominal and working or effective horse-power; the ratio of tonnage to horse-power usually regarded as expressing the efficiency of a steam-ship; to assign a measure for the terms tonnage and horse-power; to enunciate a rule for calculating approximately the relation of displacement, power, and speed; thence to show the mutual relations of speed, distance to be run without recoaling, cargo, and the expenses incurred in the conveyance of goods, on a given passage; per ton weight of goods conveyed; lastly, the cost of goods transport, as affected by differences in the size of the ships employed, was examined. A letter was read from the Astronomer-Royal, F.R.S., in which he expressed the belief, that it was best in general to confirm the adoption of standards by laws, only when they had been pretty well established by usage. He therefore recommended that the proposed system should be first introduced into the customary usage of parties negotiating large contracts, and that some well-defined rules should be laid before that branch of the executive government with whom the contracts for hired steamers principally rested, as, if adopted by Government, it would soon penetrate into the merchant service.

May 23.

"On the Mutual Relations of Trade and Manufactures," by Professor Solly.

May 30.

"On Earth-Boring Machinery," by Colin Mather. Among the various systems which have been adopted, one well-known method of boring, is to attach a chisel to a series of rods which are suspended from the end of a spring pole. When the debris has accumulated so as to obstruct the progress of the chisel, the rods are withdrawn by means of a windlass, each one being separately unscrewed as it is wound up.

A tubular instrument of sheet-iron, called a shell, usually from 3 to 4 feet long, and something less in diameter than the size of the hole, with a clack at the bottom, is then substituted for the chisel, and the rods are screwed together again and lowered. Another method generally resorted to, when the weight of the rods is so great as to overcome the elasticity of the spring pole, is that in which a rope is substituted for the rods, the impulsive motion being obtained by coiling the rope several times round a windlass, and then suddenly slacking it. A third method is that invented by M. Fauvelle. This apparatus consists of wrought-iron tubes screwed end to end, the lower one being armed with a cutting tool somewhat larger in diameter than the tubes, so as to leave an annular space around them, up which the water and the excavated material are forced, by means of a column of water sent down the tubes by a force pump.

Having thus briefly described some of the methods in general use, the author next proceeded to explain a machine he had invented, in which the construction of the boring head and the shell pump, and the mode of acquiring the percussive motion, constitute the chief novelties. The boring head consists of a wrought-iron bar about 8 feet long, on the lower part of which is fitted a block of cast-iron, in which the chisels or cutters are firmly secured. Above the chisels an iron casting is fixed to the bar, by which the boring head is kept steady and perpendicular in the hole. A mechanical arrangement is provided, by which the boring head is compelled to move round a part of a revolution at each stroke.

The shell pump is a cylinder of cast-iron, to the top of which is attached a wrought-iron guide. The cylinder is fitted with a bucket similar to that of a common lifting pump, with an india-rubber valve. At the bottom of the cylinder is a clack, which also acts on the same principle as that of a common lifting pump, but it is slightly modified to suit the particular purpose to which it is here applied. The bottom clack is not fastened to the cylinder, but works in a frame attached to a rod which passes through the bucket, and through a wrought-iron guide at the top of the cylinder. The percussive motion is produced by means of a steam cylinder, which is fitted with a piston of 15 inches diameter, having a rod of cast-iron 7 inches square branching off to a fork, in which is a pulley of about 3 feet in diameter, of sufficient breadth for the rope to pass over, and with flanges to keep it in its place. As the boring head and piston will both fall by their own weight, when the steam is shut off, and the exhaust valves opened, the steam is admitted only at the bottom of the cylinder. The exhaust port is a few inches higher than the steam port, so that there is always an elastic cushion of steam of that thickness for the piston to fall upon. The valves are opened and shut by a self-acting motion derived from the action of the piston itself.

The following facts obtained from the use of the machine, in boring in the new red sandstone at Manchester, show its actual performance. The boring head is lowered at the rate of 500 feet a minute; the percussive motion is performed at the rate of 24 blows a minute, and being continued ten minutes, the cutters in that time penetrate 5 to 6 inches; it is then wound up at 300 feet a minute. The shell pump is then lowered at the rate of 500 feet a minute, the pumping continued for one minute and a half, and being charged, the pump is wound up at 300 feet a minute. It is then emptied, and the operation repeated, which can be accomplished three times in ten minutes at a depth of 200 feet. The whole of one operation in the deepening of the hole 5 to 6 inches, and cleansing it of debris, ready for the resulting cutters or boring head being again introduced, is seen to occupy an interval of twenty minutes only.

The value of these facts will be best shown by comparing them with the results by the old method. At Highgate, the boring has occupied two years in attaining a depth of 680 feet from the bottom of a well 500 feet deep from the surface. Their progress at present is at the rate of 6 inches per week, working night and day. At Warwick, thirteen months were occupied in boring 400 feet through red marl; at Saltaire, two years in going 80 yards.

By the new machine, the work at Highgate could have been done in 33 days, that at Warwick in 20 days, and that at Saltaire, to supply the workpeople with drinking water, in 29 days.

INSTITUTION OF CIVIL ENGINEERS.

May 15, 1855.

"Description of the Landore Viaduct on the line of the South Wales Railway," by Mr. L. E. Fletcher.

"On the Infiltration of Salt Water to the Springs of Wells under London and Liverpool," by Mr. F. Braithwaite.

May 22.

Discussion on Mr. F. Braithwaite's paper. At the close of this, the main business of the evening, attention was directed to specimens of clay pots and hollow bricks, used by M. Vabre in forming roofs and floors by a combination of wrought-iron girders, supporting flat arches composed of these pots and hollow bricks. The system was stated to have been successfully applied, and the constructions were light, durable, and fireproof.

A model of Messrs. Mather and Platt's boring apparatus was also shown.

At the close of the meeting, the President announced that there was now in course of construction upon the line of extension of the water-mains of the Chelsea Water Works Company, a pipe aqueduct, crossing the Thames from Putney to Fulham, and supported upon Mitchell's patent cast-iron screw piles, now so extensively employed in engineering works. The structure was sufficiently advanced to be interesting to the profession, and he therefore had authorised the secretary of the Institution to issue orders for admission to the work to any member who applied for himself or his friends.

After the meeting, an improved Sliding Rule was exhibited, and explained by Mr. Charles Hoare, by whom the modifications had been devised; there was much that was new and useful in the arrangement, and the changes introduced would evidently simplify the method of using an instrument scarcely yet sufficiently understood, and certainly not so extensively employed in making calculations as it deserved to be.

The chief advantages of the New Rule were a series of new guage-points, by which brickwork of any thickness could be converted to standard or cubic measure: a table of constants, to facilitate the forming of estimates, and the guage-points for polygons and circles, very clearly tabulated; with concise formulæ for the various operations, which, with the necessary guage-points, were engraved on the face of the instrument, thus preventing the necessity for trusting to, or taxing the memory.

By some slight mechanical improvements it was also made useful in plan drawing, and the whole was evidently got up with the care and excellence of manufacture generally found in the rules and scales manufactured by Mr. Tree.

THE ROYAL GEOGRAPHICAL SOCIETY.

May 28, 1855.

The anniversary meeting was held this day at the Society's house in Whitehall Place, the Earl of Ellesmere, the president, in the chair. The report was a very gratifying one, announcing, as it did, the possession of a house of the Society's own, and the general prosperity of its operations. The Patron's gold medal has been awarded to Dr. Livingston for his recent explorations in Africa, between Lake Ngami and the Portuguese settlements on the west coast; and a testimonial of the value of twenty-five guineas in surveying instruments, bearing a suitable inscription, to Mr. Charles John Anderson, for his travels in South-western Africa, as laid down in his route-map communicated to the Society.

MONTHLY NOTES.

Recent Improvements in Levelling Instruments:—Johnston's Registering Dial Level; Evans' Revolving Spirit Level.—A very simple arrangement of levelling apparatus, which must be serviceable for a great variety of ordinary work, has been contrived by Mr. J. Johnston of Aberdeen, and brought out under the form represented in the annexed figure. The bottom line of the horizontal piece nf wood, is the levelling surface or base line. In the upper part of the centre of this block, there is recessed a flat circular case of brass, containing a pendulous graduated dial, set on a delicate centre pivot. This dial, or indicating card, is graduated to show degrees of altitude, as well as the inches per foot of inclination, and being weighted in the line of zero, that line always stands square with the horizontal line of the base block when the latter is on a level. The front of the dial case is covered in with glass, and upon this glass is a horizontal hair line, coincident with the line of the block. Hence the degree of inclination is at once shown on application to any inclined surface by the deviation of the dial from the hair line on the glass.

Fig. 1.

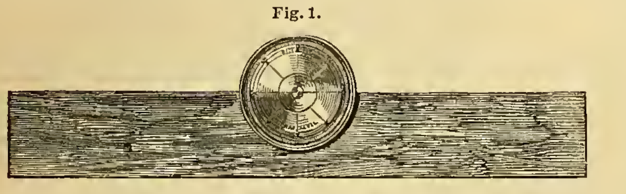
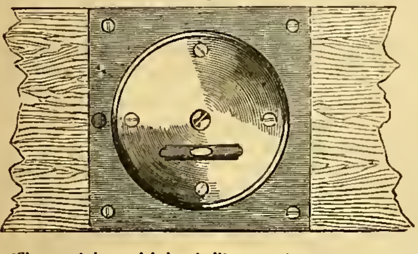
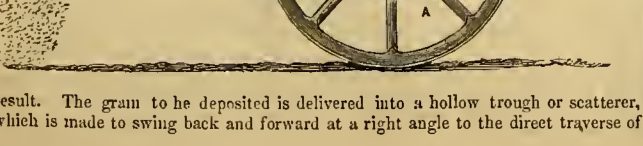


Fig. 2.



The revolving spirit level, illustrated by our second figure, is the invention of Mr. H. W. Evans of Philadelphia. It can be used both for levelling and plumbing, and all the intermediate varieties of application. The levelling block is recessed to form a seat for the brass case of a central disc, which is carried on a fixed stud centre; to the under side of this disc is secured the tube with the usual spirit bubble. The pin on the left edge of the square metal flange, is the head of a spring which projects into the metal case, and enters detent recesses in the case at the back of each of the four pins shown upon the disc. By pressing on the spring pin, and turning the disc until any of the four detent recesses become engaged, is the instrument at once set for a level corresponding to the particular detent engaged. When set round until the spirit tube is at a right angle with the base block, it answers as a plumb rule, and so on for the other relations.

American Seed Sower.—A mechanical contrivance for imitating the action of the hand in sowing, has recently been introduced in America with a successful result. The grain to be deposited is delivered into a hollow trough or scatterer, which is made to swing back and forward at a right angle to the direct traverse of the implement over the field, the seed being thus spread out to a considerable distance on each side of the path of the sower. Our engraving represents the sower in sectional elevation, and with a separate detail of the scroll drum for swinging the distributor. The machine is carried upon a pair of wheels, a, and it is drawn by shafts to the right. The grain hopper is at b, near the seat, c, of the driver. From this hopper the seed drops down through a tube opening at its lower end into the expanding trough distributor, d, having a sieve at its extreme end for the seed to fall through. This distributor is carried upon a fixed stud centre, f, as a swinging joint. The extreme forward end of the distributor carries a vertical pin, which enters a zigzag scroll groove cut in the periphery of the drum, g, on the main axle. Thus, as the drum revolves, the zigzag action upon the forward end of the trough produces a widely swinging traverse of the discharging end where the grain falls to the earth; a rapid vertical shake is also given to the distributor by an undulating piece, h, fast to the frame, and having a stud pulley of the distributor bearing upon it.



Foreign Compliments to British Geographers.—At a late meeting of the Royal Geographical Society, Sir R. S. Murchison, the vice-president, announced that the Geographical Society of Paris had very courteously transmitted to the council, through its vice-president, M. De la Roquette, three medals for presentation to three members of the society, to whom they had been awarded by the French geographers. To Captain M'Clure, R.N., the gold medal had been awarded, for his discovery of the North-west passage; to Captain Inglefield, R.N., a silver medal had been awarded, for his discoveries in the Arctic regions; and to Mr. Francis Galton a silver medal had also been awarded, for his explorations in the Namaqua, Damara, and Ovampo countries, northward of the Orange River in South-west Africa. The chairman expressed his conviction that the society would join in the cordial feelings with which the council appreciated the honours which France had so liberally conferred, and the meeting had the gratification of witnessing the presentation of the medals to Captain M'Clure, Captain Inglefield, and Mr. Galton, who severally offered their acknowledgments.

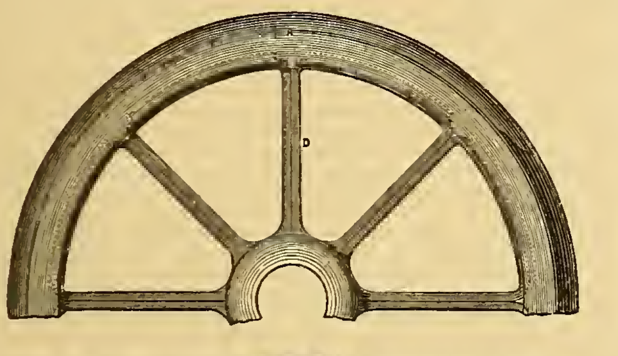
Closing of the Royal College of Chemistry.—The "Science and Art" Department of the Board of Trade has now absorbed this undertaking, and a special committee having been appointed to close its affairs, Lord Ashburton took the opportunity of presenting a testimonial from the Council, and a piece of plate from some private friends, to Dr. Hoffman, the able and energetic head of the college. In executing his commission, the noble Chairman of the Council addressed the meeting in historical and critical language, to an effect which deserves to be recorded and remembered. "Ten years ago a body of gentlemen met together for the purpose of taking into consideration the state of chemical science in this country. They were aware that chemistry was at least as earnestly, as successfully cultivated here as elsewhere; but then there existed this difference, most essential to the character of our people, to the welfare of our industry—that it was prosecuted, as the abstract sciences are prosecuted, by a few enthusiastic men of genius like Davy or Faraday, while the science itself, and the higher art immediately dependent on it, were almost ignored by our gentry, our manufacturers, and the great mass of the people. Just as before the Reformation the Holy Scriptures were sealed books in the hands of the priest—just as, at the present moment, the law of England is a sealed book in the hands of the legal profession, so was chemistry, from no fault, no jealousy of its votaries, a sealed book to the incurious, I may almost say, stolid and barbarian indifference of Englishmen. I am at a loss to find in the history of civilized nations a parallel for such an anomaly, but I do find it in the artificial organization of Egyptian society in ancient times, where the whole book of knowledge was revealed to the initiated, while the masses were deluded with fables and nursed in ignorance. The fault there was owing to the studied policy of a designing priesthood; the fault here lay with the people themselves, who had eyes that would not see, and minds that would not understand. Such was the wilful state of ignorance in this country when these gentlemen met together to devise a remedy. It was of no use to await the regenerative agency of that great moving principle in the organization of English society—competition. Let there be a demand, and competition will supply to London the loaves and fishes it may require, so that there shall be enough for each, and nothing over to waste. Create a demand, and competition will convey excursionists to take their pastime with the leviathan in the bosom of the sea; but where there is no demand, where there is nothing tangible and immediate to be gained, there competition is dead, for the soul of competition is gain. There was, therefore, no resource left but to proceed at once to create a demand for knowledge by greatly facilitating the means of acquiring it. I remember hearing from a benevolent Russian gentleman, that, after having in vain attempted to induce his peasants to cultivate potatoes by the offer of seed, he at last effected his object by leaving his own crop unprotected. The peasants took readily what they found at their feet without cost and without labour, and his object was gained. We had no similar means of imparting chemical knowledge without cost or without labour; but, adopting his principle, we determined to diminish the cost of learning by one-half, and the labour of learning much more than one-half, by such improved methods of instruction as had long prevailed in the schools of France and Germany."

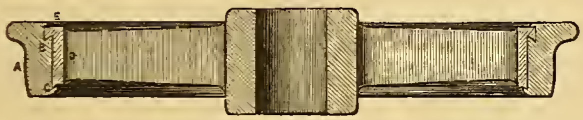
New Members of the Royal Society.—The Council of the Royal Society have recommended the following gentlemen for election out of the candidates for the Fellowship:—A. Connell, W. Farr, W. L. F. Fischer, J. Fletcher, W. J. Hamilton, J. Hawkshaw, J. Hippisley, J. Luke, A. F. Osler, C. B. Vignoles, C. V. Walker, A. W. Williamson, G. F. Wilson, Dr. T. Thomson, and Dr. R. Wight. In this list there seems to be an undue preponderance of names comparatively unknown to that especial fame which ought to be the only key to the portals of the Royal Society.

Peat Gas for Illuminating Purposes.—The question of the production of illuminating gas from peat or bog earth, has had some fresh light thrown upon it by Messrs. J. Campbell & Co. of Mary Street, Dublin, who, under the superintendence of Mr. R. L. Johnson, have managed to manufacture a cubic foot of gas from half a pound of turf. Messrs. Campbell have adopted several improvements in the details of their gas-making apparatus, with the view of securing a superior yield, with due economization of the residual matter, such as tar and charcoal. The illuminating power of the peat gas is of a very fair standard, and the proportion obtained from a given weight of fuel is so great as to lead us to indulge in a hope that more may he made of our bogs in this way, than has been bitherto generally imagined.

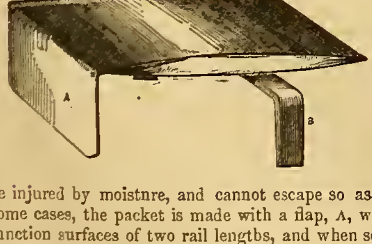
Decimal Coinage.—The House of Commons lately resolved, that in its opinion the initiation of the decimal system of coinage by the issue of the florin has been eminently successful and satisfactory, and that a further extension of such system will be of great public advantage. The resolutions were moved by Mr. Brown, member for Lancashire. The first one was carried by a majority of 79, and the second without a division. The contemplated change, though admitted by every one to be very desirable in the abstract, is unfortunately attended with some complexity, and has consequently given rise to a great variety of opinion as to the mode of carrying it out. We are glad to see that the matter is making progress in the public mind, and its advocates should lose no opportunity of enforcing the great advantages of the proposed alterations with the view of converting apathy into an earnest wish for a better state of things.

Wharton's Safety Railway Wheels.—Mr. Wharton, of Birmingham, has recently patented what he terms a "Safety Railway Wheel," in which the chief object aimed at, is the prevention of the separation of the tyre from the wheel in case of its breaking. In ordinary wheels, when a tyre happens to give way whilst the wheels are running, the pieces fly off and occasionally cause considerable damage; but in the improved safety wheel, the pieces are retained upon the wheel notwithstanding that the tyre may be broken in several places. Fig. 1 is a face view of a portion of a railway wheel constructed on the improved system, and fig. 2 is a transverse section corresponding. The tyre, A, of the wheel is turned out internally with inclined grooves at B and C, and the rim portions of the spoke pieces, D, are formed with suitable inclined lips to fit into the grooves B and C. The tyres are put on in a heated state, and a narrow lip, E, is riveted or clinched over the rim portions of the spokes, so as to retain them laterally. The spoke portions of these wheels may be constructed according to any of the various systems in use. The spokes represented in the figure are of the kind generally termed "back-to-back," being composed of bars bent into triangles, and having the boss cast upon them.





Routledge's Detonating Railway Signal.—This signal, as an improvement upon the ordinary "fog-signal," consists of a packet of some explosive compound, susceptible of being fired by concussion; and it is placed upon the rail so as to be exploded by the passage over it of the locomotive, when it is necessary to stop a coming train or to call the attention of the driver. Our engraving is a perspective representation of the explosive signalling contrivance, which is simply an oblong packet made of tin plate, or other thin metal. Both ends of the packet are tapered or made wedge-shaped, so that it is not liable to be struck off the rail by the wheel of the locomotive. The packet is completely soldered up, so that its contents cannot be injured by moisture, and cannot escape so as to cause accidental ignition. In some cases, the packet is made with a flap, A, which is to be inserted between the junction surfaces of two rail lengths, and when so fixed, it cannot be removed from the rails by the brushes usually fitted to the locomotive to clear off snow in the winter season. When for ordinary use, only a lead clip, B, is soldered to the packet, so as to hold it upon the rail.



Exhibition of German Pictures, London.—This is the third exhibition of paintings by German artists in London. It consists of one hundred subjects, chiefly landscapes and conversation pieces. Amongst the former, the works of Gude, Bodom, Steinecke, and Leu are best worthy of notice, the scenery represented being chiefly Norwegian, cascades, fiords, and sterile snow-capped mountains. Amongst the conversation pieces, the works of Tidemand, Wischebrink, and Siegert most attracted our attention; some interiors by Achenbach, and some fruit pieces by Preyer, were marked by good effects. We thought that the historical subjects and battle pieces were failures. Comparing these pictures with works by English artists, we think that the palm for colour and execution must incontestably be awarded to the latter. Still the exhibition is interesting from its giving us scenery with which many of us are unacquainted, and from showing us new points of view in the survey of nature.

New Cattle Market, London.—About the middle of last month, the new cattle market in Copenhagen Fields, formed by the Corporation of London at an expense of £400,000, was formally opened by Prince Albert; and the *Times* speaks of the event as one of the most important that has taken place for some time in the local history of London. The site selected was a piece of open ground near the Model Prison, between the districts of Highbury and Kentish-town, a situation very convenient for the forwarding of stock by the railways of the Eastern Counties, the Great Northern, and the Great Western Companies. Here 75 acres of land have been purchased, of which about 15 acres are occupied by the market itself, which is therefore nine acres larger than Smithfield market. The price averaged £800 per acre. The market is a square of 800 feet, paved with granite, surrounded by an ornamental railing, and having a clock tower 150 feet high in the centre. The space affords accommodation for 36,000 sheep, 6,400 bullocks, 1,400 calves, and 900 pigs. One half the market will be given up to cattle, the other half to sheep, pigs, and calves. Many contrivances have been adopted for facilitating the exhibition and removal of the stock. The tower has an illuminated clock, for use on dark winter mornings, and at its base are the offices of the market superintendent, the banking-houses for the money business of the market, and an electric telegraph station. A large supply of water is kept in tanks near at hand, and there are means for flushing every part of the floor of the market. Outside the market are lairs, slaughter-houses, and taverns, all built by corporation funds. At a future time it is intended to form a hide market, and a building for the exhibition of agricultural implements. Mr. Bunning was the architect of this work, which the Prince described as not only deserving of all admiration in itself, on account of the excellence of the arrangements and the magnificence of the design, but one eminently conducive to the comfort and health of the city of London.

New Dock, Portsmouth.—A new dock has been lately completed in the Government dockyard, Portsmouth; and has received the name of the Royal Victoria and Albert Dock. It is 335 feet long, 82 feet broad, 29 feet deep, with an entrance 70 feet wide. It is longer by 50 feet than any of the other docks, and has cost £63,000. The materials used, consisted of 3,000,000 of bricks, 152,359 cubic feet of stone, 729 cwt. of iron, and 94,783 cubit feet of timber. Mr. Edmund Smith, C.E., was the contractor. It was opened by the entrance into it of the Queen's new yacht, which is now nearly finished.

New Locomotive on the Maryport and Carlisle Railway.—Mr. George Tosh, the active locomotive superintendent of the Maryport and Carlisle Railway, has lately introduced upon his line some fine engines of great size and high qualifications for work. At a recent trial, instituted for the purpose of settling the question of performance, one of these steam horses had attached to it a hundred waggons of the Newcastle and Carlisle Company's line, giving a gross load of 445 tons, and a net load of 273 tons of iron ore. The trip was one of 28 miles, over ground involving ascending gradients for 9 miles east of Maryport, the heaviest lift being a mile incline of I in 192, terminating at the Aspatria station. The distance was run in one hour and forty-five minutes; and the cost of conveyance of the paying load was 2½d. per ton per 28 miles, the calculation taking in all the items of locomotive power, wages, materials for repairs, and a proportion for renewal of engine and tender. The diameter of the engine's cylinders is 16⅝ inches. Stroke, 22 inches. Six coupled wheels, 4 feet 7 inches in diameter. Heating surface in tubes, 1181 feet. In fire-box, 84 feet. Valves set to blow off at 120 pounds. Weight of engine in working condition, 26 tons 12 hundredweight. Total cost £2,175.

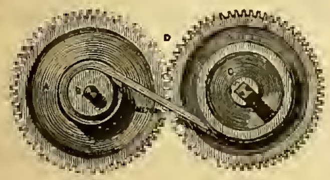
Modern War Gunnery.—Messrs. Platt, of Oldham, who, from cotton-spinning machinery, have gone into the war missile trade, have set up one of Messrs. Sibley's large circular plate-cutting machines, for use in the manufacture of bombshells. The Ordnance and Admiralty Boards are often reasonably grumbled at for delay in their examinations and decisions on new inventions. What they have to undertake in this way, is not so well known as it ought to be. Those who know what it is to have critical dealings with the owners of novelties, will perhaps bestow some sympathy upon the government examiners, when they are made aware that some five hundred separate schemes have been submitted to the Board of Ordnance alone, during the first four months of the present year. These are for machinery and fire-arms only.

Mr. W. G. Armstrong, the well-known maker of hydrostatic cranes, has been testing a steel field gun on the Northumbrian coast; he repeatedly hit a five feet target at 2,200 yards.

Mr. Dundas, writing in reply to our last month's remarks upon his "barrel" gun, says that he has a five-pounder gun of this kind in the French Exhibition, which was completely successful in its trials here. He has also made a nine-pounder, weighing 18 cwt., the junctions of which he describes as so perfect as to be indiscernible. With this gun he has good practice at a target at 1,500 yards, using 3 and 3½ pounds of powder. After twenty-four rounds, no displacement of the parts was at all perceptible. If adopted under governmental auspices, Mr. Dundas proposes to use cast-steel staves or bore pieces rolled to the proper curvature for the gun's calibre. In using these stave pieces in the formation of a gun, they are dressed on their fitting edges, and then temporarily hooped in the position which they are ultimately intended to occupy; in this condition the bound-up staves are turned up parallel exteriorly; and the hoop carrying the trunnions, already turned and finished, having been faced in the lathe, and turned out to a bore slightly less than the diameter of the tube of staves, is expanded by heat and then shrunk on its place. In doubly-hooped guns, all the first tier or inner series of hoops are similarly put on from the two ends of the piece; these hoops are then all turned parallel, and the outer tier of hoops are put on in like manner, the lines of hoops breaking bond. The staves at both ends of the gun are riveted in the extreme end hoops, and the outer tier is also riveted into the inner one. The boring is accomplished by a bar supported at both ends, the operation being completed by boring out the breech conically, and fitting in the end plug from the muzzle. This nine-pounder, after a display in front of the War-office in Whitehall, has been sent to Woolwich for trial.

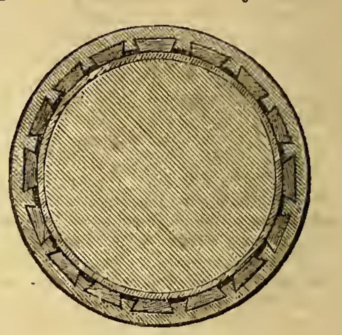
Major Jacob, C.B., has been busying himself on the subject of gunnery affairs for a considerable time, and he has determined upon a cylindro-conoidal shot, which seems to have worked extremely well in practice. This shot consists of a cylindrical base part, carrying four wing pieces to fit the grooves of the rifle, and an upper part, four times the height of the base; the form of this upper part being that of a pointed cone with curved sides. In delineating this missile, the inventor proceeds thus:—He first draws a base line of the intended diameter of the bottom of the shot, and at a distance of half a diameter he draws a second line parallel to the first; this second line is extended on each side to a distance from the shot's axis of two diameters. The two extremities of this line give the centres for two arcs of circles, which form the conoidal part. With this shot a good marksman, says the inventor, can put nearly every one into a four-feet target at 1000 yards. In experimenting with this shot as originally contrived, it was found that the explosion knocked it out of shape; and as it was necessary to have a soft base to facilitate accommodation to the barrel, a compromise was effected by combining a hard zinc cone with a leaden base. These lead-zinc shot are longer than those which we have described, the cone being equal to a diameter and a half, and the base is of the same height. When made to fit a 24 bore, they proved effective at 2,000 yards, penetrating at that distance to a depth of four inches in hard sun-dried bricks. The turn of the rifle grooves is equal to a whole round in 24 inches. Major Jacob gives it as his opinion that a four-grooved four-inch bore iron gun, weighing 24 cwt., may be made to throw a shot 10 miles.

Jones' Uniform Spring Movement for Time-Keepers.—This contrivance is designed to effect the same thing as Mr. Weber's patent time-keeper movement, described in the present part;* but whilst, in the latter case, two metallic springs are used, in Mr. Jones' arrangement a single india-rubber cord is employed, the tension of which cord constitutes the spring action. The india-rubber cord, A, is fixed by its extremities to two barrels, B, C. The barrel, C, is twice the size of the barrel, B, but both barrels are geared together by the spur wheels, D, which are of exactly the same size and number of teeth. In setting the apparatus, the india-rubber cord, A, is first fixed to the smaller barrel, B, and is wrapped round it with but little tensional strain. Its opposite end is then fixed to the barrel, C, and the two barrels being geared together as described, the barrel, C, is turned so as to wind up the cord upon it. The gearing only allows the barrel, B, to give off half as much cord as is taken up by the barrel, C, and the cord is accordingly stretched to double its length in passing from the smaller to the larger barrel. The cord does not slip upon the barrels, or if it has any tendency to do so, the barrels' surfaces must be roughened to prevent it. Then the cord being wound upon the barrel, C, that portion of it which extends between the two barrels will exert a contractile strain, and, by reason of the greater leverage of the barrel, C, this barrel will turn. As the barrel, C, turns, it will, by means of the wheels, D, wind upon the barrel, B, each increment of the cord which is given off by itself, and as each increment is relaxed in passing from C to B, and wound upon the barrel, B, the barrel, C, will give off a fresh increment of stretched cord, which comes into action as the power of the previous increment is being exhausted. The barrels are thus being turned by the tensional action of the portion of the cord between them, and the length and tension of this cord remain constant as long as any of the cord is left upon the barrel, C. There are several ways of working out the principle embodied in this contrivance. Thus the barrels, B and C, may be made equal in size, whilst the wheels, D, are made of different diameters; or the wheels, D, may be dispensed with, the barrels, B and C, being fixed on one spindle, whilst the cord, A, is conducted from one to the other over a pulley or loose roller.



Captain Norton's Alarm Signal for Railways.—Two important advantages are secured in Captain Norton's recent improvements upon the engine-driver's alarm signal. These are, the firing considerably in advance of the locomotive, at breast height from the ground, and the certainty of explosion. The signal is in the form of a small brass cannon, without a touch-hole, and about one inch bore. The charge of powder is about an ounce, and the discharge is effected by one of the inventor's "frictional corks" placed in the bore like the cork of a ginger beer bottle, being secured so as not to draw out by the pull on the wire. This petard can be hung at any height required, on a post at the point where the signal is to be made. The cord connected to the frictional wire is carried round a post about fifty yards off, and it is tied to another post on the opposite side of the line, and at a height of about five feet, to keep it above deep snow or other interfering bodies; and it is fired by the action of the engine itself, at a distance of 50 or even 100 yards in advance of the driver. These signals are now made by Mr. Darby, the firework manufacturer of Regent Street, Lambeth, their cost being 4d. each.

Wood-lined Bearings for Shafts.—Messrs. John Penn & Son have recently, with much success, applied a novel kind of lining to the stern bearings of the shafts of screw propellers. Our engraving represents a section of the shaft journal and bearing. The journal is covered with a thin belt of brass, which forms the rubbing surface of the shaft. The fixed rubbing surfaces of the bearing are composed of strips or segments of *lignum vitæ*, or other hard wood. These segments of wood are fitted into dovetail grooves in the casing, and small spaces are left between each strip to allow the water to enter and keep the rubbing surfaces cool. The segments may be made to key up when worn, by being fitted into wedge-shaped grooves. This kind of bearing seems peculiarly adapted for the situation in which the exigences of the screw propeller have caused it to be applied.



Coal Mine Accidents.—In the report of the select committee of the House of Commons, it is stated, with regard to ventilation, that the evidence preponderates in favour of the furnace system, not only as most effective but as most economical. Where the coal lies near the surface of the ground, the steam jet and Struve's machine may be applied with advantage. The enforcement of any particular system by the legislature is not recommended, but it is considered expedient that the law should enforce the adoption of some plan at every colliery for the purpose of adequately ventilating it, and pouring into it a sufficient current of air to neutralise the effect of the noxious gases. The committee say that care ought to be taken to make and maintain the main air-ways of sufficient capacity and number, and that the stoppings and crossings should be made so strong that a blast will not disturb them; and they consider that the long-wall working, where it can be adopted, is preferable to the pillar-and-stall system. They think that inspectors should be increased in number, and their salaries augmented, so that they should not be obliged to take references and other private business, but have an adequate recompense for giving their whole time to their work. They strongly deprecate the butty or contract system, and recommend that some few rules be enforced by the legislature; that pits and shafts be properly fenced when not at work, and that working and pumping pits and shafts, where the natural strata are not safe, be securely cased or lined; that a proper indicator be affixed to every machine for raising or lowering persons, and single-link chains not used, except the short coupling chain at the end of a rope; that some proper means be provided of signalling from underground to the surface, and *vice versâ*; and that every steam-boiler shall be provided with a proper steam-guage, water-guage, and safety-valve. Finally, the committee recommend grants in aid for the establishment of mining schools for the overlookers and officers of mines, and a plan for compelling the attendance of boys between 10 and 14 at school for 150 hours in every six months—a plan proposed by Mr. Seymour Tremenheere, approved at a meeting of masters, and, after some hesitation, acquiesced in by delegates of the workmen. The committee rely on improved ventilation, efficient supervision, increased inspection, and the education of all persons engaged in this dangerous branch of commercial enterprise, for the decrease of accidents in coal-mines, and they urge Government to revise the law, and enact special provisions to remedy existing evils as soon as possible.

The Coal Trade.—In 1853 there were 3,758,123 tons of coals exported from the United Kingdom, the declared value being £1,507,950. The exports of cinders and culm amounted to 177,939 tons, and the declared value to £96,641. In 1854 there were exported from the United Kingdom 4,119,712 tons of coals, 184,028 tons of cinders, and 5,515 tons of culm, the declared value of the whole being £2,127,156. The coals were distributed amongst the following countries as under:—

	Tons.
France,........................	806,384.
Denmark,......................	364,203.
Hanseatic Towns,..........	312,388.
Prussia,.......................	257,288.
Turkey,........................	255,424.
United States,..............	185,008.
Italy,...........................	171,591.
Malta,..........................	161,415.
Spain,..........................	144,794.
Holland,.......................	129,291.
British North America,...	125,052.
Brazil,.........................	112,818.
Foreign West Indies,.....	108,856.
British West Indies,......	100,109.
Sweden,.......................	95,365.
Norway,.......................	81,480.
Portugal,.....................	64,140.
Egypt,.........................	55,414.
Gibraltar,....................	49,000.
Australia,....................	43,247.
Chili,...........................	38,261.
Aden,..........................	32,013.
Greece,.......................	27,526.
Algeria,.......................	24,060.
Peru,...........................	18,154.
China,.........................	16,854.

In 1854, 3,399,561 tons of coals were conveyed into London coastways, and 979,171 tons by land. The sum of these quantities exceeded by 351,747 tons the total quantity conveyed into London in 1853. These statistics are taken from a Parliamentary report.

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* At page 86.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded January 19.

148. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and 39 Rue de l'Echiquier, Paris—Improvements in obtaining electro-motive power.—(Communication.)

Recorded February 21.

379. Julien A. Telle, Paris, and 32 Essex-street, Strand—Invention of a system of railways to be used in the interior of cities and towns.

Recorded March 13.

557. Eugène Bourserret. Paris—Improvements in machines for manufacturing bolts, rivets, and other similar articles.

Recorded March 22.

635. James Snowden, Dartford—An improvement in furnaces and other fire-places.

Recorded March 26.

667. Henry C. Hill, Parker-street, Kingsland—Improvements in the manufacture of waterproof flocked cloth and other fabrics.

Recorded April 3.

745. Louis Cornides, 4 Trafalgar-square, Charing-cross—Certain improvements in saturating and coating or covering leather, paper, and textile fabrics, so as to render the same on the coated or covered surfaces thereof impervious to water.

Recorded April 13.

817. William Weallens, 12 Elswick-villas, and George A. Crow, Forth-street, Newcastle-on-Tyne—Improvements in marine steam engines.

Recorded April 18.

860. Henry Harvey, 73 Denbigh-street, Pimlico—Invention of the application of cork in all its forms in the manufacture of beds, mattrasses, cushions, and seats.

Recorded April 19.

865. Thomas Jackson, Commercial-road, Pimlico—Improvements in signals for railway trains.
869. Charles M'I. Congreve, New York—Improvements in the manufacture of iron when oxide iron ores are used.—(Communication.)

Recorded April 23.

902. Alexander Balan, Paris—Improvements in transporting passengers and goods.
904. Joseph Wright, 12 Sussex-terrace, Islington, and Edward Brimble, 32 Cheapside—Improvements in the manufacture of stays or corsets, and in the means or method of fastening the same.
906. Alfred Jenkin, Zell-on-the-Moselle, Prussia—Improvements in furnaces for the reduction and calcination of lead and copper ores.
908. William Gossage, Widnes, Lancashire—Improvements in the manufacture of certain kinds of soap.

Recorded April 25.

919. Henry Cockcroft, Haslingden, Lancaster—Invention of a self-registering letter-box.

Recorded April 30.

964. Robert Burns, Liverpool—Improvements in propelling vessels.
966. John Walworth and Daniel Taylor, Manchester—An improved stand pipe for hydrants.
968. Archibald Buchanan and James Barclay, Catrine, Ayrshire—Improvements in beetling or finishing textile fabrics.
970. Pierre Dépierre, 101 Rue de Seine, Paris—Improvements in dyeing, part of which improvements is applicable to the manufacture of ink.—(Communication.)

Recorded May 1.

971. James Torbitt, Belfast—Improvements in the treatment and preservation of a constituent part of the potato.
972. Thomas Hunt, London and North-Western Railway Engine Works, Crewe—Improvements in the permanent ways of railways.
973. William Eassie, Gloucester—Improvements in machinery or apparatus for stopping or retarding railway trains.
975. William Hartley, Bury, Lancashire—Improvements in safety valves, and in apparatus connected therewith, applicable also to regulating the flow of steam for other purposes.
976. James E. Boyd, Hither-green, Lewisham, Kent—Invention of a "ship's course indicator or exhibitor," for the purpose of exhibiting to the helmsman and others, in a legible manner, the course which a ship is to steer, as well as for certain improvements in ships' compasses.
977. George Fisher, Cardiff—An improved buffer for railway carriages.
978. Lemuel W. Wright, Birmingham—Certain improvements in locks.
979. William Banks, Henry Hampson, and John Banks, all of Bolton-le-Moors, Lancashire—Improvements in machinery or apparatus for bleaching yarns or thread either in the cop or hank.
980. Robert Adcock, Wolverhampton—Improvements in the purifying processes of alcoholic liquids.—(Communication.)
981. William Hemsley, Melbourne, near Derby—Improvements in cutting warp fabrics.

Recorded May 2.

982. John S. Lillie, 4 South-street, Finsbury—Improvements in tents and other moveable habitations.
983. Thomas Lambert, Harrington-square—Improvements in pianofortes.
984. Frederick W. Harrold, Birmingham—An improvement or improvements in the manufacture of the frames of slates used for writing on.—(Communication.)
985. Samuel W. Campain, Deeping Fens, Lincolnshire—Improved machinery for filling corn and other sacks.
986. Henry Lee, the younger, Lambeth, and John Gilbert, Hackney-road—Invention of certain machinery for mixing the substances used in the formation of concrete and other like substances.
987. Thomas R. Bridson, Bolton-le-Moors, Lancashire—Improvements in preparing, beetling, or finishing textile fabrics.
988. Marie A. C. Mellier, 47 Rue de Seine, St. Germain, Paris—An improvement in the manufacture of paper.

Recorded May 3.

989. William Basford, Penclawdd, Glamorganshire—Improvements in purifying coal gas, and for obtaining a residium therefrom, which may be used as a pigment or colour, or for other useful purposes.
990. John Burgess, jun., Birmingham—A new or improved comb.
991. William Rowett, Liverpool—Improvements in fitting, banding, and reefing vessels' sails.
992. John Platt, Oldham, and James Taylor, Hollinwood, near Oldham—Improvements in looms for weaving.

Recorded May 4.

993. Thomas Horton, Birmingham—An improvement in the manufacture of charcoal and pyroligneous acid.
994. Fielding Fletcher, Birmingham—Certain improvements in water-closets.
995. William H. Marks, London—Invention of signalling the approach of vessels at sea.
996. Rodolphe Thiers, Lyons, France, and 32 Essex-street, Strand—Invention of a machine for manufacturing stretchers of umbrellas and parasols.
998. Joseph Lacassagne and Rodolphe Thiers, both of Lyons, France, and 32 Essex-street, Strand—Invention of an electro-metric regulator for electric telegraphing, lighting, and electro-motive purposes.
999. John Hamilton, junior, James-street, Liverpool—Improvements in the construction of iron girders.
1000. Daniel Dalton, Chester—Improvements in furnaces for the smelting iron ore and ironstone, and other stones and ores.
1001. John Trotman, 42 Cornhill—Improvements in the manufacture of screw and other submerged propellers.

Recorded May 5.

1002. Robert Midgley, Salterlee Mill, Halifax, and George Collier, Halifax—Improvements in preparing yarn for weaving and other purposes.
1003. Joseph Beaumont, Elland, Yorkshire—Improvements in treating wheat meal obtained in the manufacture of flour.
1004. Alexander Brandon, Paris—Improvements in heating and warming apparatus.
1005. James H. Dickson, Rotherhithe, Surrey—Improvements in machinery for scutching and heckling flax, hemp, and other vegetable fibres.
1006. Matthew Butcher and Thomas H. Newey, Birmingham—Improvements in forge hammers.
1007. Samuel Roberts, Hull—Improvements in steam-engines.
1008. Henri G. A. Pecoul, Paris, and 4 South-street, Finsbury—Invention of a new mode of generating power in steam-engines.

Recorded May 7.

1009. Robert Broadbent, Stalybridge, Cheshire, and Squire Farron and Benjamin Grundy, both of Ashton, Lancashire—Certain improvements in steam-engines.
1010. James Pearson, Pyle House, Totterdown, near Bristol—Improvements in the method of fastening tyres on wheels.
1011. Henri Marquis de Balestrino, Genoa—Improvements in obtaining motive power by the aid of explosive gases.—(Communication.)
1012. Daniel Foxwell, Manchester—Improvements in machinery or apparatus for making wire cards, and in the manufacture thereof.
1013. Enoch Price, Bute Docks, Cardiff—Improvements in daylight reflectors.
1014. Ebenezer Tyzack, Abbey Dale Works, Sheffield—An improvement in scythes.
1015. Robert Clark, 420 Gallowgate, Glasgow—Improvements in obtaining elastic finish to piece goods.
1016. Johnson Hands, Epsom—Improvements in boiler and other furnaces and flues.
1017. Thomas Bazley, Manchester—Improvements in the construction and arrangement of creels used in machines for winding, reeling, and doubling fibrous yarns or threads.
1018. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture of paper and cardboard.—(Communication from Francis J. Bérendorf, Paris.)
1019. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in hair and other pins used as dress or ornament fastenings.—(Communication from Eugène Bourdon, Paris.)
1020. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the consumption or prevention of smoke.—(Communication from Etienne Bourgeois, Rheims, France.)
1021. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in cocks and valves.—(Communication from Nicholas Laforest and François Eugène Boudeville, Rheims, France.)
1022. James Lewis, Holborn—An improved soap.

Recorded May 8.

1023. William B. Wilton, Lowestoft, Suffolk—Improvements in furnaces for steam-engines.
1024. Charles C. E. Minié, Paris, and 32 Essex-street, Strand—Improvements in muskets or portable fire-arms.
1025. Joseph Hughes, White Hall Mills, Chapel-en-le-Frith, Derbyshire—Improvements in the manufacture of paper.
1026. Daniel Foxwell, Manchester—Improvements in sewing machines.
1027. Thomas T. Lingard, Manchester—Certain improvements in presses, which improvements are also applicable to raising heavy bodies.
1028. Richard Needham, Hollinwood, Lancashire—An improved apparatus applicable to steam-boilers, for the purpose of economising fuel, and also assisting in the generation of steam.
1029. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for the manufacture of paper tubes to be employed in connection with spinning machinery.—(Communication from Jacques Motsch, Cernay, France.)
1030. John A. Williams, Baydon, Wilts—Improvements in machinery or apparatus for driving or actuating ploughs and other implements employed in working and cultivating land.
1031. James Bowron, Tyne and Tees Glass Works, South Shields—An improvement in the manufacture of glass tiles.
1032. Benjamin Hallewell, Leeds—Improvements in drying grain which has not been subjected to the process of malting.
1033. Alfred V. Newton, 66 Chancery-lane—An improved construction of air-engine.—(Communication.)
1034. Jules J. Imbs, Brumath Town, France—Certain improvements in manufacturing cartridges or cases for containing charges for fire-arms.—(Communication.)
1035. Thomas Williams, Red Lion-street, Clerkenwell, and John H. Fuller, New Brentford, Middlesex—Improvements in wrenches, pliers, and spanners.

Recorded May 9.

1036. Robert K. Bowley, Charing-cross—Improvements in boots and shoes, and other coverings for the human foot.
1037. John Gedge, 4 Wellington-street-south, Strand—An apparatus for cleansing rooms or other spaces.—(Communication.)
1038. John Gedge, 4 Wellington-street-south, Strand—Improvements in the manufacture of woven or textile fabrics.—(Communication.)
1039. John Gedge, 4 Wellington-street-south, Strand—Improvements in cases for spectacles and similar articles.—(Communication.)
1040. Edward Cockey, Henry Cockey, and Francis C. Cockey, of the firm of Edward Cockey and Sons, Frome Iron Foundry, Somerset—Improvements in clod crushers and land rollers.

1041. John M. Worrall, Salford—Certain improvements in machinery or apparatus for cutting piled goods or fabrics.
1042. John M. Worrall, Salford—Certain improvements in machinery or apparatus for cutting piled goods or fabrics.
1043. Richard S. Markindale, Salford—An improved method of removing wool from sheepskins and other peltry.
1044. Duncan Morrison, Bordesley Works, Birmingham—Improvements in the manufacture of metallic bedsteads, sofas, and other articles to sit or recline on.
1045. George Taylor, 22 Water-street, Liverpool—Improvements in steam-engine governors.—(Communication.)
1047. Cullen Whipple, United States—Invention for preparing and combing wool.
1048. Samuel Grainicher, Zofingen, Switzerland—Certain improvements in the construction of pumps, parts of which improvements are also applicable to steam-engines.—(Communication.)

Recorded May 10.

1049. Charles Mertens, Gheel, Belgium, and 32 Essex-street, Strand—Improvements in breaking and scutching flax, hemp, and other fibrous matters, and in the machinery employed therein.
1050. John W. Lewis, Manchester—Improvements in lightning conductors.
1051. Edwin A. Forbush, Ashland, Massachusetts, U.S.—An improved machine for sewing leather, cloth, &c.
1052. William Scott and Alfred Powell, Birmingham—Improvements in apparatus or machinery to be employed for the purpose of rifling and draw-boring gun-barrels and ordnance.
1053. Alfred V. Newton, 66 Chancery-lane—An improved mode of preparing colours for printing and staining fabrics.—(Communication.)
1054. Matthew Allen, Worship-street—An improved valve, particularly applicable for regulating the supply of air to furnaces and fire-places.
1055. Edward Eastwood, Long Eaton, Derbyshire—Improvements in certain parts of railway carriages.
1056. Frederick W. Norton, Edinburgh—Improvements in the manufacture or production of figured pile fabrics.
1057. John Harris, Woodside, and Thomas Summerson, West Auckland, both near Darlington—An improvement in the manufacture of iron railway wheels.
1058. Charles J. Hunt, Willows, Mitcham—Improvements in tug and other hooks.

Recorded May 11.

1059. Joseph Hallam, Sheffield, and John Elce, Manchester—Improvements in the construction of rowels or toothed cylinders for self-acting temples and other purposes.
1060. Edward Humphries and Thomas Humphries, Pershore, Worcestershire—Improvements in machine riddles for separating straw from grain, and for other similar purposes.
1062. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture of sulphuric acid.—(Communication from Jean F. Persoz, Paris.)
1063. Constantine Henderson, Tufnell-park—Improvements in the construction and arrangement of locks.
1064. Joseph Pascall, Chislehurst, and George Fry, Lee, both of Kent—Improvements in blanching, forcing, and propagating garden pots.
1065. James Steele, Greenock—Improvements in effecting the drainage of moulded sugar.

Recorded May 12.

1069. Frederick G. Sanders, Poole, Dorsetshire—Improvements in brick, pipe, and tile machines.
1070. George Robinson, Manchester—An improved invalid's bed.
1071. John Herdman, Belfast—Improvements in the manufacture of wrought-iron plates, adapted for shipbuilding, and other purposes for which strength and lightness are required.
1072. William B. Adams, 1 Adam-street, Adelphi—Improvements in the construction and propulsion of vessels for navigation moved by internal power.
1073. James Beckett, Preston—Improvements in machinery for spinning cotton and other fibrous substances, more particularly applicable to the machines generally known by the name of Smith's self-acting mules.
1074. George Whyatt, Openshaw, Lancashire—Certain improvements in machinery or apparatus for cutting piled goods or fabrics.
1075. John H. Linsey, Coleman-street—Certain improvements in account-books, and other large books.
1076. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and Paris—Improvements in machinery for boring or perforating stone and other materials.—(Communication.)
1077. Florent J. Pieton, Wignehies-town, France—Certain improvements in knitting machinery.
1078. William Dray, Swan-lane—Improvements in the manufacture of frames for all kinds of structures, together with the means of fastening the same when necessary, part of which is applicable to the manufacture of screws and bolts.
1079. François A. Theroulde, Paris—Improvements in preserving animal substances.—(Communication.)
1080. Thomas Rickett, Watling Works, Stony Stratford—Improvements in the construction of pressure guages.
1081. John Dupre, Plymouth—Improvements in the construction of ovens.—(Communication.)

Recorded May 14.

1082. John Higgins, Oldham—Improvements in steam boilers and apparatus connected therewith.
1083. William Robertson, Edinburgh—Improvements in the treatment of fuel, and its use for heating purposes.
1084. James Pettigrue, Drumcree, Westmeath, and Dublin—Improvements in propelling vessels.
1085. Robert M'Connel, Glasgow—Improvements in beams or girders for building or structural purposes.
1086. Robert Morrison, Newcastle-upon-Tyne—Improvements in steam-engines.
1087. James Buchanan, Glasgow—Improvements in the manufacture of heddles or healds for weaving.—(Partly a communication.)
1088. Thomas C. Eastwood and Thomas Wheatley, Bradford—Improvements in preparing and combing wool and other fibrous substances.
1089. John Mason, Samuel Thornton, and Leonard Kaberry, Rochdale—Improvements in machinery or apparatus for preparing cotton and other fibrous substances for spinning yarns or threads, and for finishing or polishing such yarns or threads.
1090. Alexander Robertson, Sheffield—Improvements in the construction of stoves and fire-grates.
1091. Robert S. Newall, Gateshead—Improvements in apparatus employed in laying down submarine electric telegraphic wires.
1092. Alfred C. Garratt, Massachusetts—Invention for facilitating the work of lubricating the axles or bearings of carriage wheels.
1093. Levi L. Hill, Westhill, Greene, U.S.—Improvements in silvering glass.
1094. John Lackmann, Hamburgh—An improvement in the manufacture of sheet iron.—(Communication.)
1095. George T. Bousfield, 8 Sussex-place, Loughborough-road, Brixton—An improvement in burning hydro-carbons in lamps.—(Communication.)

Recorded May 15.

1096. Peter Christie, Greenock—An improved tent or hut for soldiers in the field, emigrants, tourists, and other persons requiring a portable dwelling.
1097. Robert Jobson, Holly Hall Works, Dudley, and John Jobson, Litchurch Works, near Derby—Improvements in the manufacture of moulds for casting metals.
1098. William Fawcett, John Lamb, and Francis B. Fawcett, Kidderminster—Improvements in the manufacture of carpets and other similar fabrics, and in machinery and apparatus to be used therein.
1099. George T. Bousfield, 8 Sussex-place, Loughborough-road, Brixton—Improvements in the manufacture of wrought nails.—(Communication.)

Recorded May 16.

1100. George Saxon, Openshaw, near Manchester—Improvements in the construction of safety plugs for steam-boilers and in valves for steam-engines.
1102. Thomas Richardson, Leeds—Improvements in dyeing cloth.
1103. Alphonsé René Le Mire de Normandy, 67 Judd-street, Brunswick-square—Certain improvements in converting fatty and oily substances into fatty and oily acids and into soap.
1104. Edward P. Plenty and William Pain, Newbury, Berkshire—An improvement in ploughs.
1105. Charles W. Siemens, John-street, Adelphi—Improvements in cooling and in freezing water and other bodies.
1107. Robert Jamieson, Ashton-under-Lyne—An improved machine, or improvements in machinery or apparatus, for forming or forging the burrs or nuts for screw-bolts, applicable also to forming, forging, or completing blanks for bolts and pieces of metal for other purposes.
1108. Robert Vessey and Edmund Vessey, both of Bath—Certain improvements in carriage steps.
1109. John H. Porter, Birmingham—Improvements in coupling blocks for trusses employed in roofs and other structures generally.
1111. Robert Murdoch, Cranhill, Glasgow—Improvements in agricultural apparatus for sowing seeds and for depositing manure.
1112. Wharton Rye, Miles Platting, near Manchester—An improved railway wheel, which may also be employed for other similar purposes.

Recorded May 17.

1113. Thomas Dawson, King's Arms-yard—Improvements in cases for containing pen, ink, and stamps.
1114. Alexandre M. Mennet, Paris—Certain improvements in ornamenting textile and other fabrics.
1115. Jean G. Butt and Jean A. Martin, both of Paris, and 32 Essex-street, Strand—Invention of a new system of rotary steam-engines.
1116. William Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture, treatment, and application of oily, resinous, and gummy substances and soaps.—(Communication.)
1117. Frederick D. Blyth, Birmingham—Improvements in the manufacture of tea trays, picture frames, and other similar articles from papier maché.
1118. James Rae, Alpha-road, New-cross—Improvements in warming railway passenger carriages and compartments in steam vessels.

Recorded May 18.

1120. Benoit T. Warée, Paris, and 32 Essex-street, Strand—A new or improved apparatus for sharpening pencils.
1121. Charles C. E. Minié, Paris, and 32 Essex-street, Strand—Improvements in breech-loading fire-arms.
1122. Julius Jeffreys, Kingston, Surrey—Improvements in sun-blinds or solar screens.
1123. Edmund Morewood and George Rogers, Enfield—An improvement in coating wrought-iron.
1124. John Cumming, Glasgow—Improvements in looms for weaving.
1125. William H. D. Granville, Stokenchurch, Oxfordshire—Improvements in fire-arms and cartridges for the same.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

DESIGNS FOR ARTICLES OF UTILITY.

Registered from April 26 to May 22.

April 26th,	3710	J. Southgate, Watling-street,—"Camp bedstead."
—	3711	G. Epitaux and L. Stead, Pall Mall,—"Freezing apparatus."
May 4th,	3712	Alexis Soyer, Scutari,—"Teapot."
7th,	3713	W. S. Adams & Sons, Haymarket,—"Coffee mill."
9th,	3714	C. Rowland, Higher Tranmere,—"Shirt collar."
—	3715	W. Langdon, Duke-street,—"Saddle."
12th,	3716	G. W. Reynoles, Birmingham,—"Stay fastener."
15th,	3717	C. Bullinger, Selsey,—"Self-setting rat-trap."
21st,	3718	Rev. J. Burrow, Bakewell,—"Smoke preventor."
—	3719	G. Wilkins, Guildford,—"Sharp key for pianoforte."
—	3720	H. Doulton, Lambeth,—"Water-closet basin."
—	3721	W. Graham, Noble-street,—"Brace-ends."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered.

April 26th,	657	W. Langdon, Duke-street,—"Saddle."
May 3d,	658	W. Kinghorne, Great Charlotte-street,—"Railway bottle."
5th,	659	S. R. English, Birmingham,—"Blind pulley."
—	660	A. Lambert, Argyle-square,—"Whist-marker."
8th,	661	G. H. Indall, Bartholomew-lane,—"Hand signal-lamp."
14th,	662	H. C. Tucker, Ringwood,—"Casement-fastener."
—	663	H. Rodd, St. James-street,—"Quick filter."
15th,	664	H. Buck, Burnley,—"Stench-trap."
—	665	J. Cuxson and C. F. Lucas, Shiffnal,—"Fire-escape."
21st,	666	G. Forth, Chelsea,—"Anti-pressure hat."
22d,	667	J. W. C. Wren, Tottenham-court-road,—"Folding bedstead."

TO READERS AND CORRESPONDENTS.

Elastic Action Three-wheel Brougham.—We inadvertently fell into a slight error last month, in attributing the several inventions noticed under this head to Mr. Michael Scott. The patents are those of Mr. Uriah Scott, and they are being worked out by Messrs. U. Scott & Co. of 15 Duke Street, Adelphi.

Agros.—Messrs. P. Lawson & Son, seedsmen, Edinburgh, are the publishers. It is from their "private press"—price, we believe, 7s. 6d.

A. F.—The greater the difference of level the more favourable is it for the flow of water. The "32-feet" column supported by the atmosphere, does not bear upon the question.

ANNULAR SAFETY VALVES,

W. HAWTHORN, ENGINEER,

NEWCASTLE-UPON-TYNE.

Fig. 2

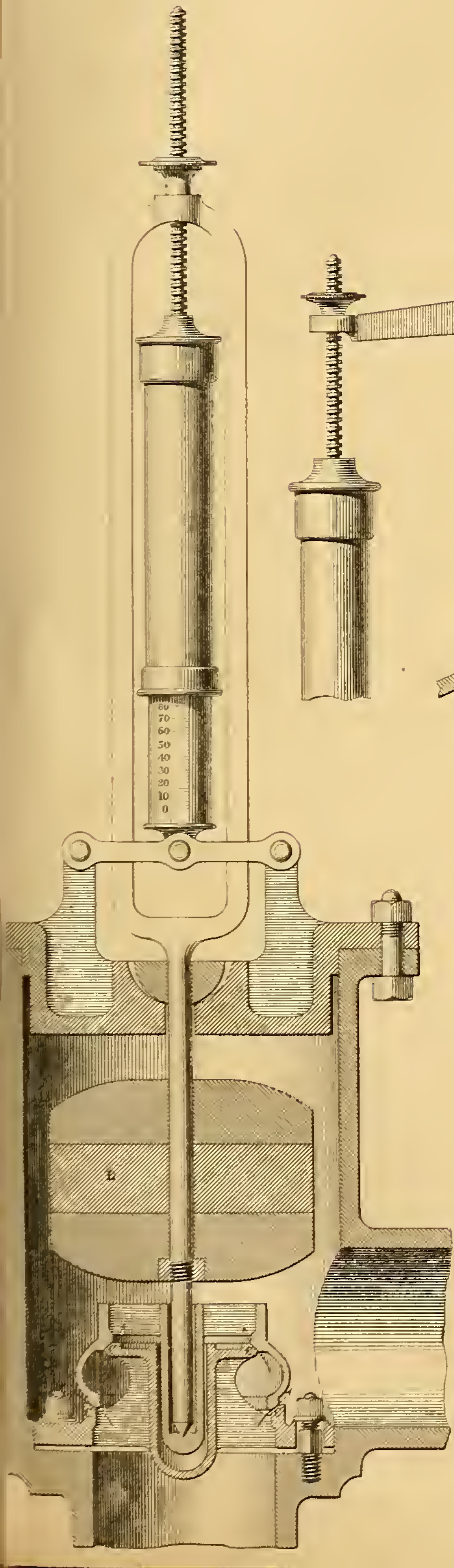


Fig. 1

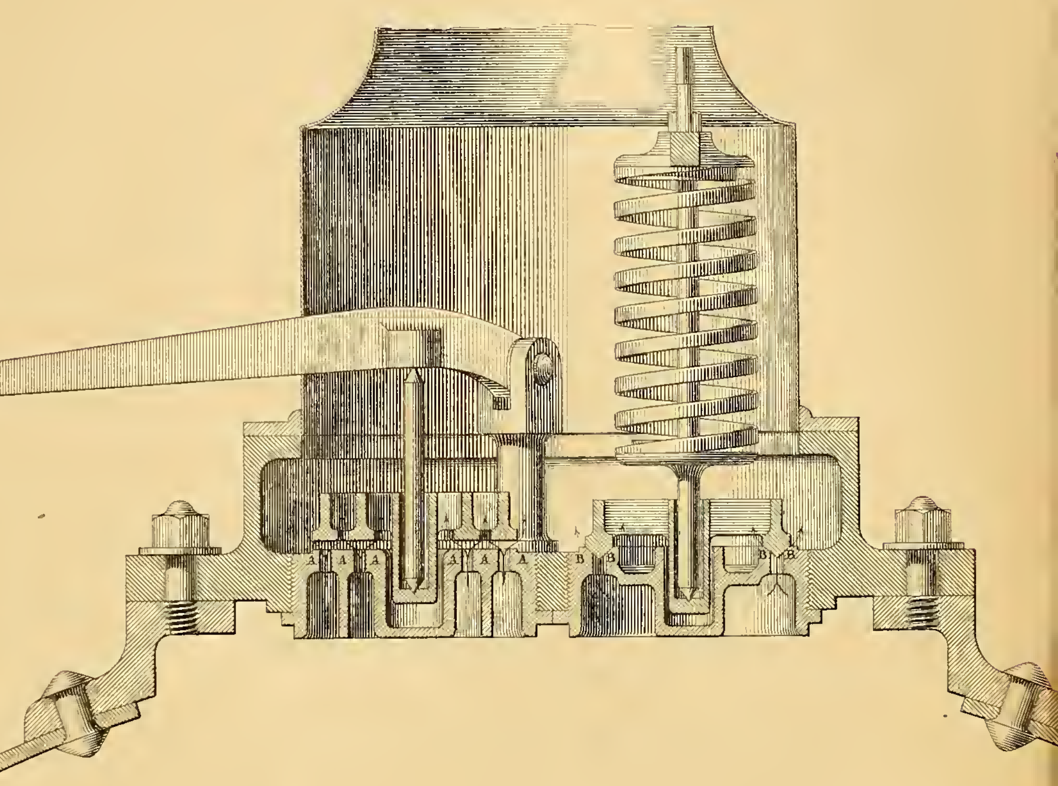


Fig. 3

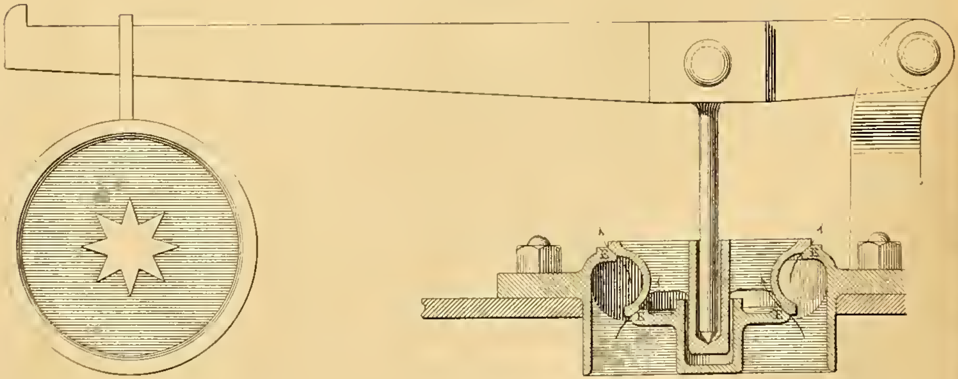
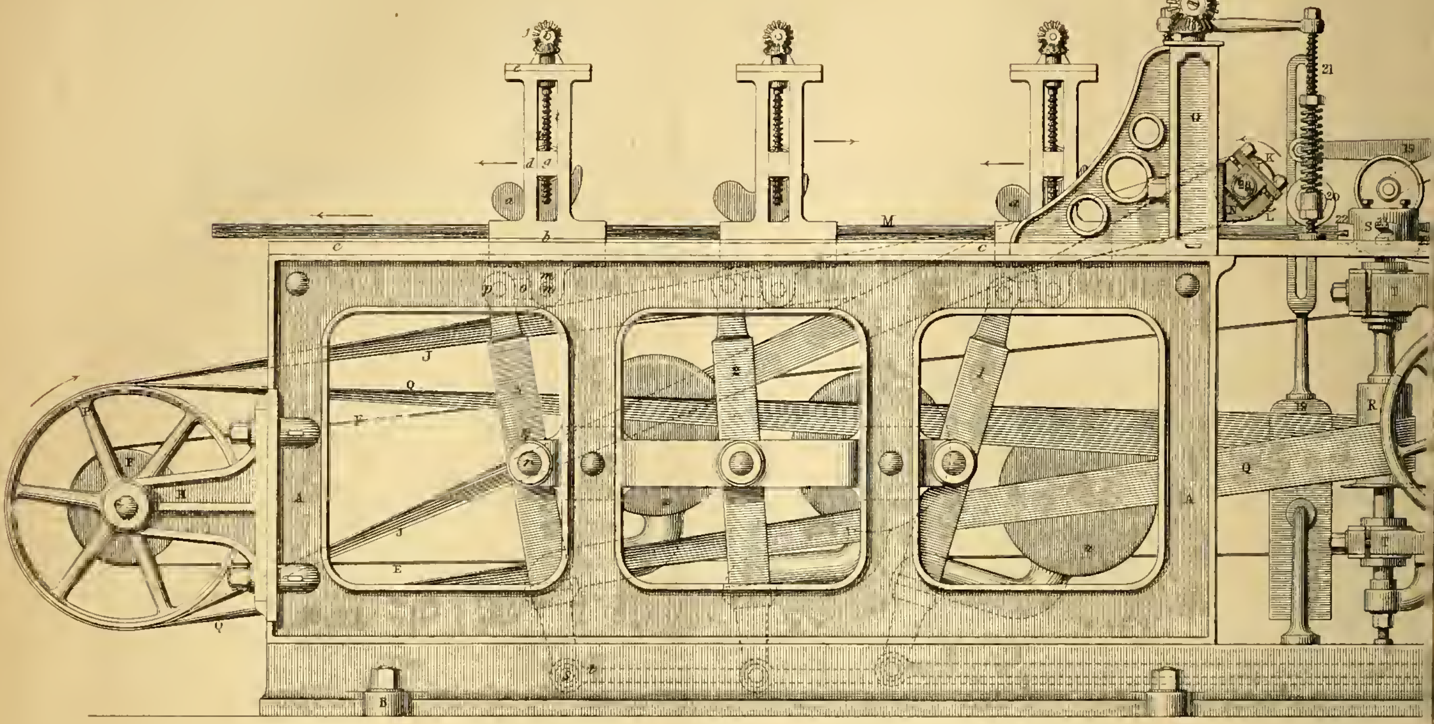


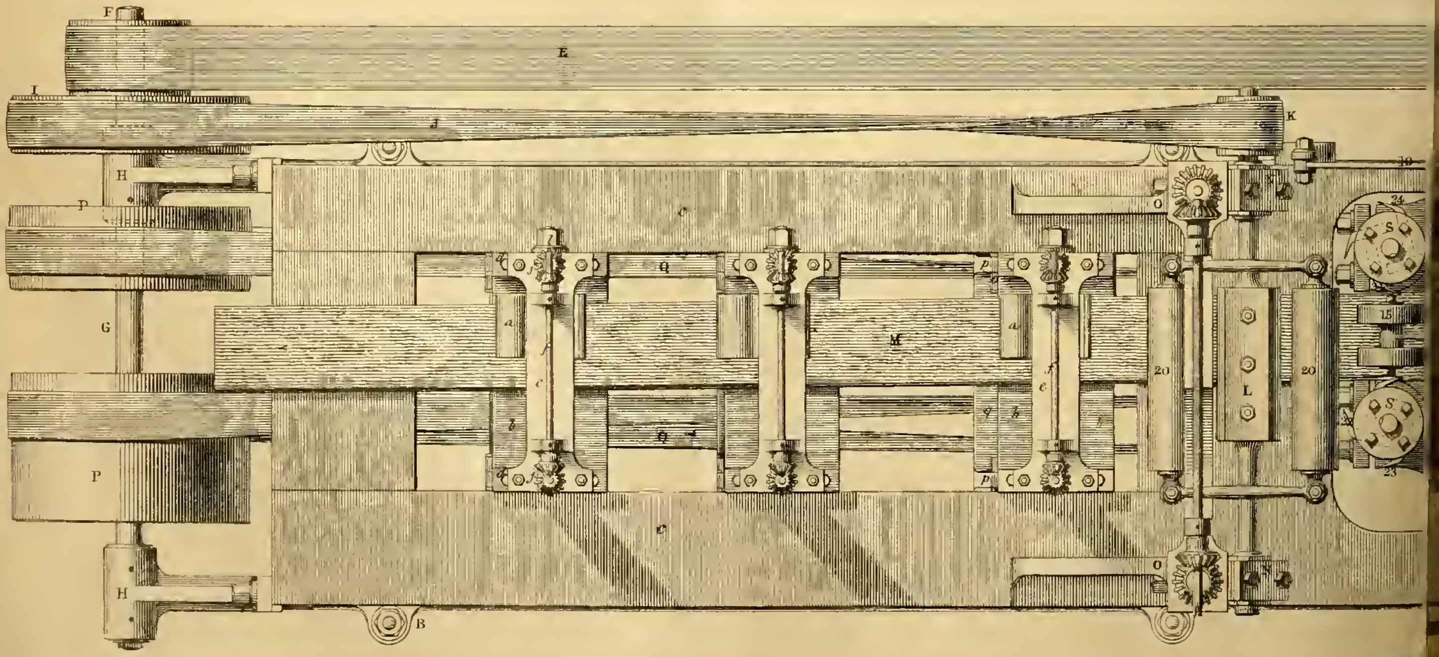
Plate 175

WOOD-PLANI

JOHN M^c DOWALL

JOH





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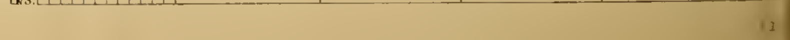
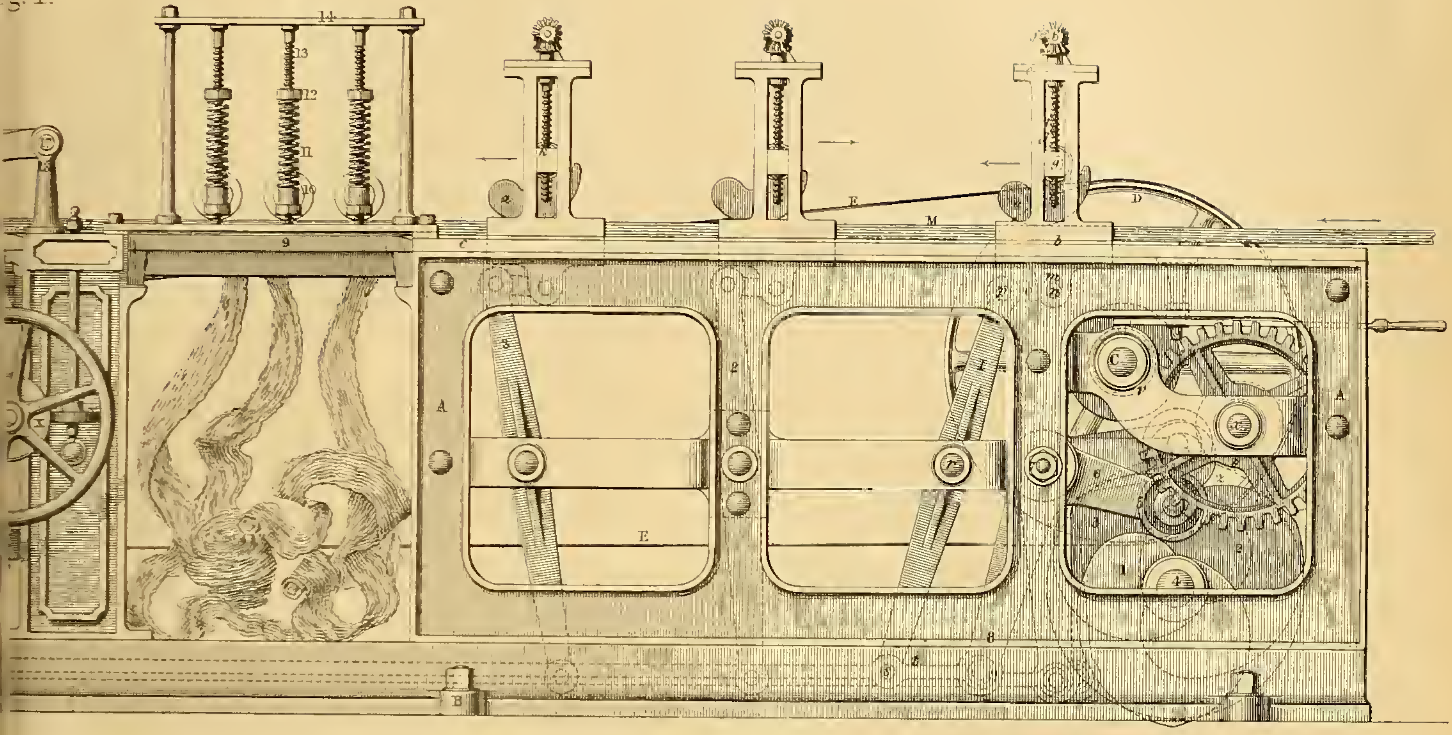


NG MACHINE.

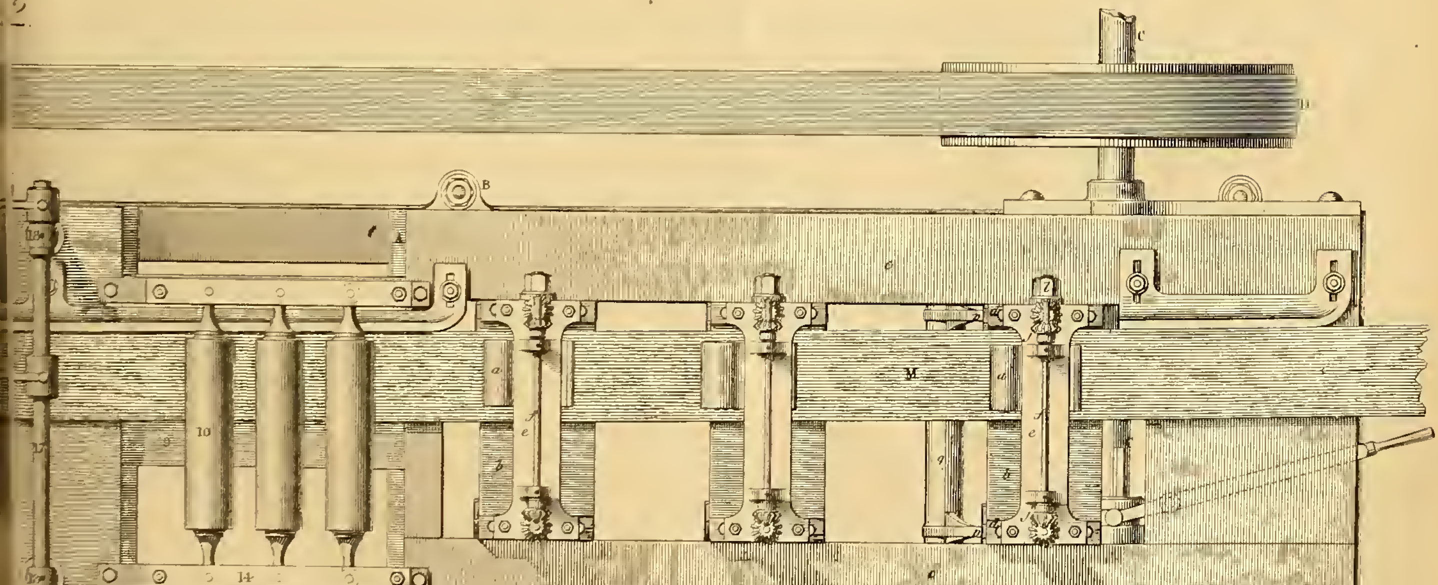
SONS, ENGINEERS,

STONE.

g.1.



2.



Engraved by J. Petitcolin

2 Pl. Brompton Lane

Scale

5

10 FEET

WOOD-PLANING MACHINE.

JOHN McDOWALL & SONS, ENGINEERS,
JOHNSTONE.

Fig. 1.

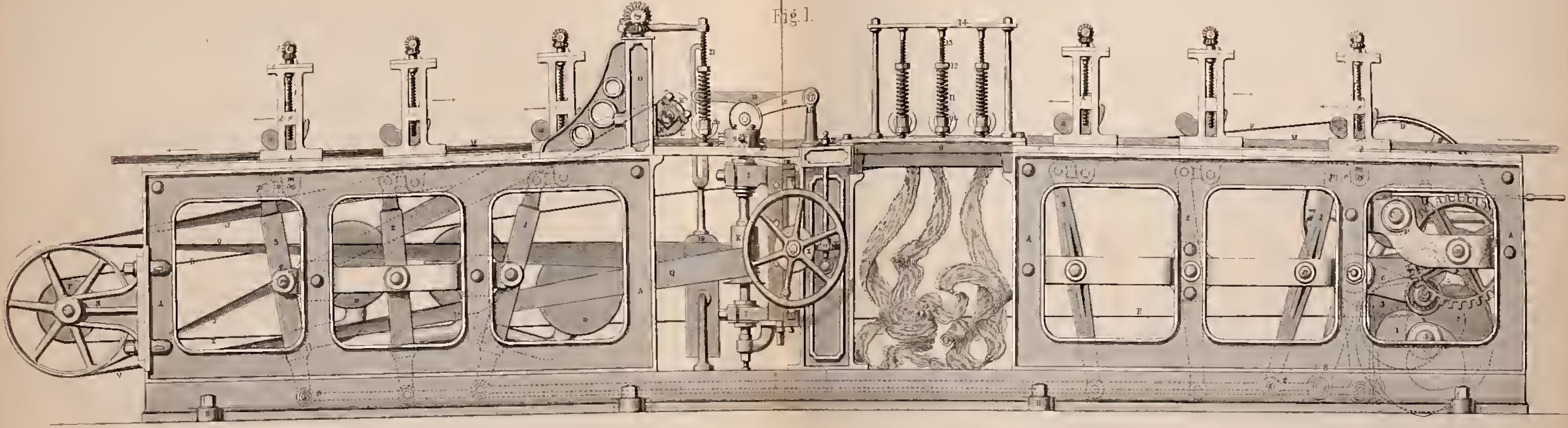
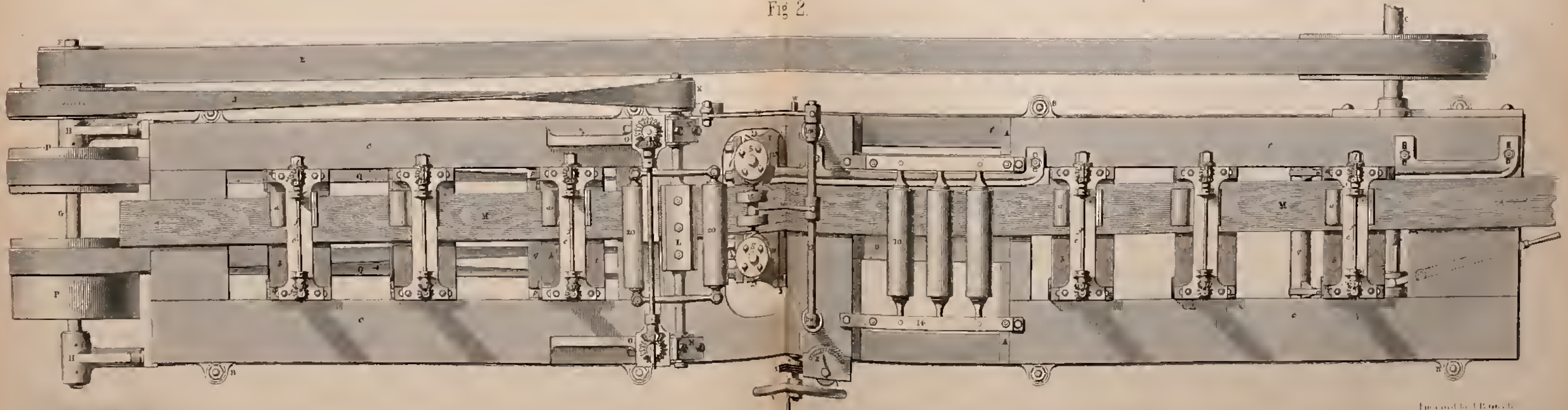


Fig 2.



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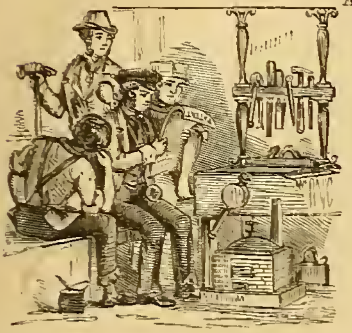
LETTERS PATENT AND HOW TO OBTAIN THEM.

By the Authors of the Patentee's Manual.



HAVING made a patentable invention, and having resolved to apply for letters patent in respect of it, an inventor's first step is to prepare three documents—viz., a petition to the Crown, a declaration verifying the statements of the petition, and a provisional specification, stating distinctly and intelligibly the whole nature of the invention, and the means by which it is to be carried into effect. The petition states, that the petitioner is in possession of an invention for (here the title of the invention must be given), which invention he believes will be of great public utility; that he is the true and first inventor thereof; and that the same is not in use by any other person or persons, to the best of his knowledge and belief. The petitioner therefore humbly prays that her Majesty will be pleased to grant unto him, his executors, administrators, and assigns, her royal letters patent for the United Kingdom of Great Britain and Ireland, the Channel Islands, and the Isle of Man, for the term of fourteen years, pursuant to the statute in that case made and provided.

The petition must be limited to one invention, for a patent is not now allowed to embrace more. The declaration echoes the statements made in the petition. In those cases where a *complete* in place of a *provisional* specification is intended to be filed, the declaration must state that the instrument in writing, under the declarant's hand and seal annexed to the declaration, particularly describes and ascertains the nature of the invention, and the manner in which the same is to be performed.

The petition and declaration must be written upon paper of a certain size, and the latter must be made before a justice of the peace, a commissioner in Chancery, or other competent authority.

Care must be taken to frame the title of the invention properly, many patents having been lost by inattention to this point, as we have shown in the Patentee's Manual. It must point out distinctly and specifically the nature of the invention, and must be neither too general nor too narrow, faults which a professional person is more likely to avoid than those not accustomed to the preparation of patent documents. If drawings are required to explain the nature of the invention, they must accompany the specification.

The three documents above mentioned being all properly prepared, signed, &c. (the petition bearing a stamp of £5), must be taken, along with a true copy of the provisional specification and the drawings, if any, to the Patent Office in London. The drawings or tracings (of which two copies are required) must be upon paper of a particular size.

The application then goes before one of the law officers of the Crown (the Attorney or Solicitor General), whose duty it is to examine the title and the provisional specification. For this purpose he can call any scientific person to his aid, or any other person likely to give him information as to the invention. If dissatisfied with the title or the specification, the law officer may require them to be amended. If satisfied that the specification properly describes the nature of the invention, he gives a certificate of his allowance, which is filed in the office of the Commissioners of Patents, and thereupon the invention becomes provisionally protected; that is to say, for six months, commencing at the date of the application, it may be used and published by the inventor without prejudice to any patent which he may afterwards obtain. It may be supposed that the allowance of the law officer renders the specification incapable of attack. But this is not so; its sufficiency may be questioned just as much as ever, and a prudent inventor will take every precaution in his power to insure correctness, without founding his security upon the law officer's approval.

The 9th section of the Patent Law Amendment Act, 1852, gives an inventor the privilege of filing a complete specification with his petition and declaration, instead of leaving a provisional specification at the office The complete specification must particularly describe and ascertain the nature of the said invention, and in what manner the same is to be performed, and it must bear a stamp of £5. The day of the delivery of the petition, declaration, and complete specification, is recorded at the office of the commissioners, and endorsed on the petition, and a certificate thereof is given to the applicant. This being done, the invention is protected for six months from the date of the application; and the applicant has most of the privileges of a patentee, including that of being able to use and publish his invention. Two copies, both provisional and complete specifications, are (15 and 16 Vict. c. 83, § 9, 15 and 16 Vict. c. 115, § 2) open to the inspection of the public as soon as they are deposited, subject to the order of the commissioners. As to provisional specifications, however, the commissioners have not thought fit to make an order, and the public, consequently, has not access to them.

The commissioners cause all inventions, whether provisionally protected, or protected by reason of the deposit of a complete specification, to be advertised in the London Gazette.

An applicant may, as soon as he thinks fit after obtaining protection in either of the above-mentioned modes, give notice at the office of the commissioners of his intention to proceed with his application, paying, at the same time, a fee of £5; whereupon the commissioners will cause his application to be advertised in the London Gazette, with the view of giving persons who have an opposing interest the opportunity of leaving written particulars of their objections to the application. A fee of £2 is paid to the commissioners on leaving with them the notice of objections.

The applicant must leave the notice of his intention to proceed at the office of the commissioners, at least eight weeks before the expiration of the term of provisional protection thereon, after which time no notice will be received at the office, except under special circumstances, and upon the allowance of the Lord Chancellor. The sum of £5 must be paid at the commissioners' office when the notice to proceed is lodged.

When the time for delivery of particulars of objection has expired (twenty-one days, calculating from the date of the Gazette, under the commissioners' rules), the provisional specification, or the complete specification, and any particulars of objection which may have been delivered, are referred to the law officer. Having heard the parties, or their agents, the law officer, if he sees no ground for stopping the patent, will make out his warrant for the sealing of it; but if the objections prevail with him, nothing further is done. The warrant is impressed with a stamp of £5. The law officer has power to obtain the assistance of scientific persons in arriving at a decision, and to order by or to whom the costs of procuring the assistance of such persons, and of the inquiry, generally or otherwise, in relation to the grant of the patent, shall be paid. He has also power to direct the insertion in the patent of such restrictions, conditions, and provisoes as he may deem usual and expedient or necessary.

The law officer's fees become very onerous in cases of opposition when the attendances before him are numerous, each side having to pay £3. 10s. for each attendance, however short. Some alteration of the practice in this respect is urgently called for. It is very desirable that an applicant should advance as quickly as possible to that stage of the proceedings where he is safe from objection. He should, therefore, place himself in the position of being able to demand the law officer's warrant whenever he pleases.

Application for the law officer's warrant and for the patent must be made at the office of the commissioners, at least twelve clear days before the expiration of provisional protection, otherwise they will not be prepared, except under special circumstances, and by the special direction of the Lord Chancellor.

Persons who are dissatisfied with the law officer's decision, or who, for any reason, did not enter an opposition before the law officer, have still an opportunity of contesting the grant of a patent. Notice of objection must be given at the commissioners' office, and a fee of £2 paid as before. A petition has then to be presented to the Lord Chancellor stating the petitioner's case, and the matter is argued by counsel in due course. If the points have been already brought before the law officer, only very peculiar circumstances will induce the Lord Chancellor to reverse his decision.

In the event of there being no opposition, or of the opposition being overruled, there only remains one more step, and that is to pay another £5 on applying at the office for the patent, the important document which it is the object of all these applications, notices, and fees to procure. In due time it will be handed to him, sealed with the great seal of the United Kingdom. The patents which now issue from the commissioners' office extend to the whole of the United Kingdom of Great Britain and Ireland, the Channel Islands, and the Isle of Man. With regard to the colonies, the commissioners have of late refused to allow a patent to extend to them.

Three months are given, from the date of the warrant (sect. 19 of Patent Law Amendment Act, 1852), to apply to seal the patent. After that time, the whole thing is at an end, if no application has been made.

It is imperative that the patent should be issued during the continuance of the provisional protection, or the protection by reason of a deposit of a complete specification. The only exceptions allowed are—firstly, where the application to seal was made in due time, and the sealing was delayed by reason of the delivery of notice of objection, or an application to the Lord Chancellor in relation to the sealing of the patent (15 and 16 Vict. c. 83, § 20); secondly, where the delay in sealing has arisen from accident, and not from the wilful neglect or default of the applicant (15 and 16 Vict. c. 115, § 6). The Chancellor, in either case, may extend the time for sealing, but not for longer than a month. The practice upon applications to extend the time, is governed by the Chancellor's rule of the 17th July, 1854.

In the case of the applicant dying during the continuance of protection, whether under a provisional or complete specification, the patent may be issued to the executors or administrators at any time within three months after the death of the applicant. But if a patentee should die before be has filed the specification required by the patent (no complete specification having been filed previous to the grant of the patent), the patent is altogether lost, this case not being touched by the act.

If no complete specification was filed before the grant of a patent, that instrument will be found to contain a clause making it void, unless the patentee shall particularly describe and ascertain the nature of his invention, and in what manner the same is to be performed, by an instrument in writing under his hand and seal, and cause the same to be filed at the Patent-office, within six calendar months after the date of the patent. If by any accident, not arising from the neglect and wilful default of the patentee, the specification should not be filed within the time mentioned in the patent, the Lord Chancellor, on special application, has power to extend the time, for not more, however, than a month. The instrument is called the specification, and a very important one it is, requiring in its preparation the patentee's most careful attention. Neglect of the requirements of the law in this respect are fatal to the validity of the patent, for inventions the most valuable may be pirated with impunity, if the specification fails to comply with the decisions of our courts. But upon this point we will not dwell here, seeing that we have entered fully into the subject in our Patentee's Manual.

Another condition contained in the patent, by non-compliance with which the instrument becomes void, is the payment to the commissioners of patents, at or before the expiration of the third year, of £50, and at or before the expiration of the seventh year, of £100.

Letters patent are usually dated as of the day of the application for the same; but the Lord Chancellor, or the law officer, has power to cause them to bear date as of the day of the sealing, or of any other day between the day of the application or provisional registration, and the day of the sealing (sect. 23). The term for which patents may be granted is limited by the statute of James to fourteen years, and it is usual to make the grant for the whole of this term. The time runs from the day of the date of the patent, including that day; for instance, a patent dated 26th February, 1825, was held to expire at twelve o'clock on the night of the 25th February, 1839.—*Russel* v. *Ledsam*, *L. J. R.*, *n. s.*, 353 *Ex.*

Large powers are reserved to the Crown by sect. 16 of the Patent Law Amendment Act, 1852; but they will probably be acted upon only in extreme cases. It has power to direct the law officer to withhold his warrant; to direct that the patent for which he has already issued his warrant shall not issue; to direct the insertion in letters patent of any conditions which it may think fit; finally, to order any complete specification, which may have been filed, to be cancelled previous to the sealing of a patent, and thereby to put an end to the protection obtained by filing the same.

Two very useful registers, accessible to the public on payment of a shilling, are kept at the office of the commissioners for patents. One is called the Register of Patents, wherein is recorded, in chronological order and with the dates, all patents granted under the recent act, as well as the deposit or filing of specifications, disclaimers, memoranda of alterations, amendments, confirmations, and extensions, and the expiry, vacating, and cancelling of patents. The other register is called the Register of Proprietors. It contains entries of the assignments of patents, or of any share or interest therein, of licensing, mentioning the districts to which they relate, with the names of persons having shares or interests in patents and licenses, and the dates of such shares or interests being acquired by such persons. Copies of entries, certified by the commissioners, may be obtained on payment of small fees, such certified copies being directed to be received in evidence in all courts and in all proceedings, and to be taken as *primâ facie* proof of the assignment, &c., as therein expressed. It is provided by the act of 1852, that, until such entry shall have been made, the grantee of the patent shall be deemed and taken to be the sole and exclusive proprietor of the patent (sect. 35). Entries may be expunged, vacated, or varied by a Judge's order under sect. 38. The making false entries in the Register of Proprietors, the forging of any writing purporting to be a copy of any entry in such register, and the tendering in evidence of any such forged writing by any one who knows it to be forged, are made misdemeanors, punishable by fine and imprisonment, by sect. 37 of the Patent Law Amendment Act, 1852.

Printed copies of all the specifications, filed under the Patent Law Amendment Act, 1852, are purchasable for a small sum at the commissioners' office, with lithographed outline copies of the drawings accompanying such specifications. Disclaimers and memoranda of alteration are likewise directed to be printed and published, by the 30th sect. of the Act of 1852.

Chronological and alphabetical indexes of all the specifications of patents enrolled in Chancery, from 1617 to the end of 1854 (21,447 in number), have been published under the authority of the commissioners, in five volumes; and an index, arranging the specifications according to the subject matter, up to 1st October, 1852, has lately appeared. Another index, called the Reference Index of Patents from 1617 to October 1, 1852, points out the office in which each enrolled specification of a patent may be consulted; the books in which specifications, law proceedings, and other subjects connected with inventions, have been noticed; also, such specifications as have been published under the commissioners' authority. These indexes, the work of Mr. Woodcroft of the Patent-office, are of great service in tracing the history of inventions. There is a very useful clause in the 15 and 16 Vict. c. 115, as to the proof of patent documents in courts of justice. The fourth section of that act directs that printed or manuscript copies or extracts, certified and sealed with the seal of the commissioners, of letters patent, specifications, disclaimers, &c., recorded and filed in the commissioners' office, or in the office in Chancery, shall be received in evidence in all courts, without further proof or production of the originals.

In addition to the office of the commissioners in London, the act directs that they shall have offices at Edinburgh and Dublin, to which copies of all specifications, &c., shall be transmitted for the inspection of the public. (Sect. 39, Patent Law Amendment Act, 1852.) Certified duplicates of all entries made in the Register of Proprietors are directed by sect. 35 to be sent to these offices for public inspection.

Transcripts of letters patent are transmitted to the director of Chancery in Scotland, to be recorded in the records of Chancery there; and extracts from the same are procurable, on payment of certain fees, which extracts are receivable in evidence in all courts of Scotland, to the like effect as the letters patent themselves. (Sect. 18.) Similar transcripts are sent to Dublin, for enrolment in the Irish Court of Chancery. When this has been done, the transcript or exemplification has the like effect as if the original letters patent had been enrolled there. (Sect. 29.)

Certified printed copies, under the seal of the commissioners, of all specifications, and complete specifications, and *fac simile* printed copies of the drawings accompanying the same, also of disclaimers, &c., filed under the Patent Law Amendment Act, are directed (sect. 5, of 15 and 16 Vict. c. 115) to be sent to the Office of the Director of Chancery of Scotland, and to the Enrolment Office of the Irish Court of Chancery, within twenty-one days of the filing; and certified copies, or extracts from such documents, are procurable by any person on payment of certain fees. Such copies or extracts can be given in evidence in all courts in Scotland and in Ireland respectively, in proceedings relating to patents for inventions, without further proof or production of the originals.

The reader has heard a good deal about the Commissioners of Patents, and he may like to know who these functionaries are. We will conclude our paper by divulging the secret. The Commissioners of Patents were called into existence by the Patent Law Amendment Act of 1852. They consist of the Lord Chancellor, the Master of the Rolls, the Attorneys-General for England and Ireland, the Lord Advocate, and the Solicitors-General for England, Scotland, and Ireland. Any three of them (the Lord Chancellor or Master of the Rolls being one) may act in the name and with the powers of the whole. The Commissioners have a Seal of Office, whereof all Courts and Judges are to take notice. They have power to make rules and regulations respecting the business that comes before them, and they have annually to present a report of their proceedings to Parliament. The whole business of the Commissioners is transacted at their office in Southampton Buildings, Chancery Lane, London; and here they have a staff of assistants and clerks, the chief of whom is Mr. B. Woodcroft, a gentleman well known in the world of inventors and patentees. A library, consisting of the scientific and mechanical works of all nations, has been established in connection with the office, and this is open to the public. From the same office issues, twice a week, a publication, called "The Commissioners of Patents' Journal." It contains a reprint of the notices relating to patents which have appeared in the London Gazette, and other matter connected with the business of the office.

ANNULAR SAFETY VALVES.

By W. Hawthorn, Esq., Forth Engine Works, Newcastle.

(*Illustrated by Plate* 174.)

The progress of mechanical improvement, of which we are so fond of boasting, has by no means put a stop to those fearful casualties, boiler explosions. Steam does, indeed, continually take in more and more work to do, and it does it well; but this grand motive power is not the safe, quiet, and manageable labourer, which the world, in virtue of our engineering successes, has a fair right to expect. In the great industrial centres of Lancashire and Yorkshire, where the practical development of the steam-engine, as a laborious drudge, has always kept a decided lead, there have lately been so many and such serious explosions, that it has been found necessary to organize a private association for their prevention. Had this step not been taken, it is very clear that the more stringent restrictions of government would have been called in; and the manufacturing chiefs have therefore acted wisely, in thus timely preventing what is always felt as a vexatious interference. If such is the condition of affairs in quarters where the highest efficiency is to be looked for, it is not surprising that searching inquiries should be made as to the causes of the severe disasters. To defective management of ill-contrived machinery, aided by inferior workmanship, we think we may safely attribute nearly every casualty of the kind. The first of these deranging influences is obviously within the steam-power employer's own jurisdiction; the other two lie at the door of the mechanical engineer. Mr. Hawthorn must have reasoned in this way when he contrived his "Annular Safety Valves," and dealt with the most important detail affecting the safe working of the steam boiler.

The pressure escape, or safety valves hitherto adopted by boilermakers, are no doubt generally capable of discharging all the steam which the boilers can generate, provided the entire area of the valves could be made available for the passage of the pent-up vapour. But the fair and honest opening of the valve by the hand, is very different to that arising from the pressure of the escaping steam. Every engine attendant knows to how slight an extent the ordinary valve of a boiler is lifted, even when high pressure steam is fiercely blowing off; and he has thus seen that the relieving area is actually confined to a narrow portion encircling the rim of the valve disc. Looking at the case in this way, then, we see that it is obviously unnecessary to subject the entire area of the valve to the pressure of long weighted levers and springs, seeing that the elevation of the rim, or circumferential part alone of the valve, is all that is required for the emission of the steam.

Mr. Hawthorn's new valve introduces special provision to meet this requirement. It furnishes any necessary extent of escape area, without any aggravation of the lift or action of the valve. This is accomplished by employing double-faced valve surfaces, with one or more rings in the same plane or otherwise, as we now illustrate in our Plate by the aid of three examples.

Fig. 1 is a sectional elevation of a pair of the new valves, combined in one chamber. The one on the left is made up of two concentric rings, combined with double faces, A. This valve is loaded by the usual spring balance lever. The other valve, on the right, is a single annular mitre, or bevil-faced piece, the parts, B, being the working faces. It is loaded by a direct-acting helical spring, abutting at its lower end upon a disc on the central holding-down pin, and held down by an overhead cross-piece.

In both these arrangements, the valve seats are screwed into a flange, or manhole door of the boiler; and by making the spindle or boss of the valve lid hollow, the valve is loaded by the weight pin at a level below that of the valve faces. The valves have thus a self-adjusting tendency, having no dependence upon the boss or pin as a guide, and they are all but frictionless in their action. These valves are suitable for locomotive, as well as other classes of boilers.

Fig. 2 is a sectional elevation of a valve with double faces, C, as suitable for marine purposes. In this example, the load is derived partly from a direct weight, D, inside the valve case, and partly from an external spring balance, applied directly to the valve spindles. The spring balance is connected at its lower end to a cross stay piece, held by the valve-chest cover, whilst its screwed spindle passes through the top bend of an open frame-piece, forming part of the spindle.

Fig. 3 is a sectional elevation of another form of valve, with double faces, E, loaded by a lever and weight in the usual way. This last form is intended for stationary or land boilers, water mains, and other pressure apparatus. The valves at present used on the larger class of locomotives are about four inches in internal diameter. Now, to give full effect to a valve of this size, the lid should be elevated to an extent equal to one-fourth of its diameter, a movement rarely or never provided for in locomotives. But even allowing the lift to be unlimited, and the load uniform, the action of the common plain disc is still very imperfect. And though the load on the valve may be constant, the working pressure of the steam in the boiler is found to increase as the evaporative power increases; and this aggravation of pressure goes on to a dangerous extent, without the area of the outlet being enlarged by the lifting power of the steam. It is this great point which Mr. Hawthorn's valve meets, by increasing the escape area for the steam, without increasing the valve elevation.

SOME FACTS ABOUT THE HEAVENS.

The Sun has a diameter of 882,000 miles; its bulk is consequently more than five hundred times greater than the aggregate bulk of all the planets which it attracts. The diameter of our Earth does not equal the hundredth part of the Sun's, and the weight of the latter body is nearly 355,000 times more than that of the former. This great central luminary revolves, like the Earth, upon its axis, but occupies twenty-five of our days in the operation. Many conjectures have been formed as to the Sun's nature, but our instruments are not yet powerful enough to tell us anything certain on that head. The most generally received supposition is, that an atmosphere of intense luminosity floats round the Sun. The dark spots which are frequently seen on its disk are supposed by those who entertain this view, to be occasioned by the partial clearing away of the atmosphere, so as to allow us to perceive the solid interior nucleus. Whilst some hold that the Sun is a solid or liquid mass in a state of white heat, others believe that the light and heat which it radiates proceed from an outer stratum of self-luminous clouds floating around it. If the Sun is in a state of incandescence, then any notion of inhabitants cannot be entertained; but if the heat thrown off proceeds from an envelope of flame, the existence of living beings upon the surface of the Sun is not rendered impossible. That the intensity of the heat at its source must be enormously great, may be guessed from the fact that, though ninety-five millions of miles distant, the Sun's rays are capable of roasting an egg at certain parts of the Earth's surface. It has been remarked by Sir John Herschel, that the Sun's heat is the ultimate source of nearly every motion which takes place on the surface of the Earth. Winds; the phenomena of terrestial magnetism; the conversion of inorganic matter into vegetable existence; the passing of water into the air in a state of vapour, from ten thousand seas and lakes, to be returned into them in the shape of rivers; those disturbances in the chemical equilibrium of the compounds of matter which give rise to an endless series of decompositions and recompositions,—all these motions are brought about by the heat of the Sun. Moreover, to the same cause must be indirectly attributed many vast geological changes, by which the surface has been modified through long past ages; for wind, rain, and the fluctuating heat of the seasons, are active agents in levelling the prominent parts of the solid land; and rivers convey the loosened particles into the ocean, which deposits them on some part of its bed. In this way, a great increase of pressure is produced on large spaces covered by water, and there is a corresponding diminution of pressure on certain parts of the land. It is easy, then, to see that the localities on the surface where volcanic fires make their appearance, may be, in process of time, completely altered.

Mercury, with a diameter of 3,200 miles, a day of 24 hours, and a year of 88 days; Venus, with a diameter of 7,700 miles, a day of 24 hours, and a year of 225 days; the Earth; Mars, with a diameter of 4,100 miles, a day of 25 hours, and a year of 687 days; Jupiter, with a diameter of 90,000 miles, a day of 10 hours, and a year of nearly 12 of our years; Saturn, with a diameter of 79,000 miles, a day of 10½ hours, and a year equal to 29½ of ours; Uranus, with a diameter of 34,500 miles, a day of 9½ hours, and a year of 84 of our years; and Neptune, with a diameter of 42,000 miles, and a year of nearly 165 of ours, revolve round the Sun, at distances varying from 68 millions of miles (Mercury's distance), to 3000 millions of miles (Neptune's distance); and together with thirty asteroids, whose orbits lie between the orbits of Mars and Jupiter, the various satellites, and a great but unknown number of comets, compose what is called the solar system. Of these planets, the Earth has one moon, Jupiter four, Saturn eight, Uranus eight, and Neptune at least one, perhaps two. Jupiter is the largest and grandest of the planets, but the rings of Saturn make him the most interesting body of our system. The rings are four in number, and one of them at least is fluid, for the body of the planet has been seen through it. Some astronomers believe that all the rings are composed of fluid matter, and that the number of them is liable to vary. Nay, it has been conjectured, from certain appearances, that the inner ring is gradually drawing nearer to Saturn, and that in the course of a few years all the rings will have become united to the planet. The innermost ring is at present only about 19,000 miles distant from Saturn, and the thickness of all the rings is computed to be 250 miles. But there is no end of singularities connected with the arrangement of this planet and his attendant bodies, for it has been found that the innermost ring is upwards of 900 miles nearer to the planet on one side than on the opposite side. Moreover, the satellites are of much more importance in retaining the rings in their position than the planet itself. Inequalities resembling mountains have been noticed upon the ring. The notion was at one time generally prevalent, that Saturn's ring had the effect of throwing darkness upon a large portion of the planet's surface for a long space of time (a solar eclipse of fifteen years' duration has been spoken of); but it has been lately shown that Saturn's diurnal rotation is so effected, that the Sun and the planet's satellites pass alternately from side to side of the ring, and that objects passing under the ring are only occulted by it for short intervals. Under circumstances rarely happening, it is true that the Sun is occulted from rising to setting, but the continuance of the phenomenon is very short in comparison with what was supposed, and the places of its occurrence much more limited.

There seems to be reason for suspecting that Neptune has a ring like Saturn, but his distance is so great that this has not been clearly made out. There can be little doubt that, with more powerful telescopes, many more satellites would be discovered in the neighbourhood of Neptune.

In considering our planetary system from a general point of view, several irregularities will be discovered, the most noticeable being, that though the orbit of Mars is exterior to the Earth's, he has no satellite; that the planets do not go on increasing in size with their distance from the Sun, for at a point half-way between the centre of attraction and the extremest of the revolving bodies, there is a numerous group of small planets, the least of the whole system, whilst the next planet to this group is the largest of all, and is succeeded by three planets considerably less in size. It is further to be remarked that Uranus, the more distant planet, has no more moons than Saturn, and has not the benefit of an illuminating ring. The motions of the planets round the Sun, and of the satellites round their primaries, are, with one exception, performed in directions from west to east. The exception takes place in the case of Uranus's satellites, which, singular to relate, move in the opposite direction. It is also to be remarked, that the planes of the orbits of these satellites are very much inclined to the ecliptic; in fact, are nearly perpendicular to that plane. As to the length of day, it will not have escaped observation, that if we exclude the asteroids and Neptune (the length of whose day is not yet known), the first four planets have a day of nearly the same length, namely, about twenty-four hours, whilst the average day of the next three planets is only ten hours. The length of the year, however, increases, as a matter of course, as the planets recede from the Sun.

There is a hypothesis very generally entertained as to the asteroids, namely, that they are the fragments of one planet which has suffered strange wreck in voyaging through the sky; but we believe there is nothing that amounts to anything like proof of the hypothesis. Another bold hypothesis has also been formed as to the motion of our Sun, drawing after him all the planets and their moons, round some body at present invisible, the position of which is attempted to be pointed out. Even the rate of motion has been calculated. If this be so, it is easy to conceive that that invisible body, in like manner, wheels round another invisible body of still greater attractive force, drawing with it not only our system, but a thousand others. And the same conception may be carried on *ad infinitum.* When we are ignorant of almost every point, it would be in vain to conjecture what may be the fate of our Earth whilst threading its way amongst the innumerable bodies that people infinite space: nor is it too much to say, that it is far from impossible that, at some period of her career, she may be dashed against some other solid moving mass, and be broken into atoms. Calculcations have indeed been made, that her equilibrium will remain undisturbed so far as the other bodies composing the solar system are concerned; but nothing can be premised or foretold as to her fate, when, in the lapse of ages, she shall have been brought nearer to those stars which are now at such an enormous distance.

Comets are a complete puzzle to those astronomers who wish to find a purpose in everything. No one has been hardy enough to assert that they are inhabited by living beings, and their uses have yet to be not only discovered but guessed. Moving in orbits which carry them at one time very near to the Sun, and at another to an immense distance (obeying, apparently, all the time, the same laws of gravitation which affect the other bodies of the solar system), the variations of temperature to which they are subject must be extremely great. The comet which appeared in March, 1843, approached so close to the Sun, that it was computed the heat received by it from that body was twenty-four times greater than the heat produced by a certain well-known lens, thirty-two inches in diameter, which melts quartz and agate by concentrating the Sun's rays upon them. The time has gone by when comets were supposed to prognosticate or bring with them wars and pestilence; but the extraordinary form of many of them must always excite great attention and stimulate conjecture. With tails that astronomers tell us are more than a hundred millions of miles in length, with velocities not far short of a million miles an hour, they may well strike all of us with astonishment; and when we see their tails increasing or decreasing with wondrous rapidity, or divided into parts, our astonishment is not likely to be lessened. Sometimes they appear without tails, sometimes with two in opposite directions, sometimes with many spreading like a fan. The extreme tenuity of cometic matter is shown by the fact, that stars can be seen through the head, which is the densest portion; and by the further fact, that the largest of them offer no sign of phase. This can only result from their being penetrated throughout by the Sun's rays, which are reflected from every part of them, interior as well as exterior. Under powerful telescopes, everything solid seems to vanish, except, in some cases, a very small point, which is probably solid. Another peculiarity of comets is, that their orbits are not confined to a certain region, but are inclined at every angle to the Earth's path. Most of them extend their journey to distances far beyond the farthest planet, but there are a few whose motions are restricted within the planetary orbits, and there is one which does not move beyond the orbit of the asteroids. There can be little doubt that they occasionally wander so far away from the Sun as to become attracted by other bodies. One comet has failed to make its appearance since 1770, although it ought to have been seen thirteen times since that date. To show the uncertainty which attends our knowledge of these bodies, it is sufficient to mention that the period of the great comet of 1680 has been calculated by three different astronomers at 575 years, 2888 years, and 8000 years.

Taking the density of the Earth to be represented by unity, then the densities of the other planets will be represented by the following numbers:—Mercury 1·12, Venus 0·92, Mars 0·95, Jupiter 0·24, Saturn 0·24, Uranus 0·95, and Neptune 0·95. Now, the Earth has been calculated to be 5½ times more dense than water, consequently the density of Jupiter and Saturn will only be about 1⅓ that of water. Calculations have been made as to the force of gravity on the surfaces of the planets, and the result shows that on Venus that force is about equal to what it is on the Earth; on Mars and Mercury only half as great; on Saturn a little greater; on Uranus and Neptune a little less; and on Jupiter 2½ times greater, so that a body weighing with us 100 pounds will on Jupiter weigh 250 pounds.

Astronomers believe they have evidence of the existence of an atmosphere around Mercury, Venus, Mars, Jupiter, and Saturn. Nay, we are told that land and water and polar snow can be distinguished upon Mars, high mountain chains upon Mercury and Venus, and that even the twilight of morning and evening can be observed in the atmosphere of the last planet. A great number of dark belts are seen upon Jupiter's disk parallel to his equator, and it is conjectured that they indicate currents in his atmosphere similar to our trade-winds.

The dark spots which are observed to dapple the Sun have caused infinite conjecture as to their origin. They are in a constant state of fluctuation; they extend over immense spaces, and the bodies advance nearer each other with very great rapidity. Some spots have had a diameter of 45,000 miles, and in closing up, the edges must have moved at the rate of 1000 miles a day. Sir William Herschel's hypothesis as to these spots was, that a stratum of highly luminous and heated clouds surrounds the Sun, from which light and heat are sent to the planets, and that between these clouds and the Sun's body there is a second stratum of cloud, which defends the enclosed body from the intense light and heat of the exterior stratum. He thought that the dark spots indicated apertures in the outer layer. A discovery of Arago's has been deemed some confirmation of this hypothesis. The discovery alluded to was, that the luminous rays, emanating from a solid body heated to a red or white heat, proceed not only from the outer surface, but also from a certain depth below. Those rays which come from below were polarized, whilst rays emanating from a flame are not polarized. Now, he ascertained that rays issuing obliquely from the Sun's surface were not polarized, and he concluded that the rays came from an envelope of luminous matter, and not from the body of the Sun itself.

The mass of the Sun is nearly 355,000 times greater than the mass of the Earth, but its density, compared with the Earth's, is little more than 0·25 to 1—that is to say, it is not much denser than water. The force of gravity at the Sun's surface is nearly thirty times heavier than at the Earth's; so that, as Sir John Herschel says, an ordinary man removed to the Sun would not only be unable to sustain his own weight, but would literally be crushed to atoms.

The moon, being the heavenly body nearest the Earth, has been more closely surveyed than any other. Mountains, some of them nearly two miles high, and vast plains, denominated seas on the maps, are the chief features of her geography. The mountains are very numerous, and nearly always circular. Besides the semblances of distinct craters, and marks of volcanic stratification, actual outbursts of fire have been observed, and Sir W. Herschel states that he was witness to the formation of two new mountains within nine days. One of the spots where igneous action was perceived must have been three miles in diameter. Whether the moon has an atmosphere seems to be a matter of doubt, some astronomers asserting that there are no indications of one, whilst others affirm that there is distinct evidence of an atmosphere, greatly attenuated; and they have estimated its height, which, they tell us, is lower than that of many mountains. The climate has been described as being an alternation of fierce heat and intense cold, each continuing for a fortnight. Where the Sun falls vertically, absolute barrenness will prevail, whilst, on the other side, hoarfrost will be gathering, the result of the evaporation caused by the Sun's rays on that face turned to him. Our telescopes are not yet powerful enough to enable us to see minute objects, such as buildings, if any such exist. Nothing like vegetation has been detected, nor any appearance of change wrought by succession of season. As the moon revolves on her own axis in exactly the same space of time as her revolution about the Earth occupies, it follows that we always see the same face, and never the other side. The mean distance of her centre from the Earth's centre is about 237,000 miles, a length equal to 9½ times the equatorial circumference of the Earth.

Leaving the confines of the Earth, and passing beyond the bounds of the solar system, what can be told about the fixed stars? Very little; for the distance which divides the Earth from them is too vast to admit of our acquiring much information respecting them. Very close observation, however, has of late years brought to light the fact, that some of them have parallax, but in no case has it been found to amount to a single second. A parallax of one second would imply a distance of about 250,000 of the Earth's radii. The most remote of those whose distance is capable of being estimated, lies at more than fifty-three millions of the Earth's radii from us. The brightest of the fixed stars is Sirius; but he is not, by any means, the nearest. The intensity of his illuminating power has been calculated to be sixty-three times greater than that of the Sun. If his magnitude be in proportion, he must be a magnificent object from any planets which may be dependent on him. Certain of the stars are periodically subject to an increase and diminution of brightness, and in some cases they become entirely invisible, and then come into sight again. There are other stars which, when viewed through the telescope, separate into two, occasionally into three, bodies. Some thousands of double stars have been discovered on a careful survey of the heavens, and, in some instances, it is plain that one star revolves round the other, so as to form a binary system. The orbits of a few have been calculated. The double star of shortest period is one in the constellation Hercules, each part of which performs its revolution round their common centre of gravity in rather more than 31 years, whilst a double star in the Crown occupies 737 years in effecting its revolution. We have here proof that the law of gravity prevails even in this remote part of space. Not only has the distance of some of the fixed stars been approximatively arrived at, but the weight or mass of one of these binary systems has been calculated. The double star known as 61 Cygni, which shines as a star of the sixth magnitude, has been calculated to have a mass about equal to half the mass of our Sun.

There remains but a small space to us to speak of those immensely distant objects, the nebulæ. Many of these objects, most of which are invisible to the naked eye, have been resolved into a multitude of stars very closely set, and appearing through instruments of low power like a wreath of vapour. The great majority of them appear as globular or spheroidal clusters of stars, which look more closely compacted near the centre than elsewhere. The more powerful the instruments employed, the more nebulæ are resolved, and hence we may conclude that those nebulæ which remain unresolved consist, nevertheless, of stars which a higher power would disclose as such. It was the irresolvability of certain nebulæ having a star of considerable brightness in the centre, that gave rise to what is called the nebular hypothesis. This hypothesis assumed that the nebulous matter surrounding such a star was self-luminous, had a gaseous nature, and was in process of condensation into stars or systems. The discoveries made by more perfect instruments, by which the nebulæ in question were seen to consist entirely of stars, have destroyed the only ground the hypothesis of sidereal aggregation had to rest on. The forms of other nebulæ have likewise undergone much alteration since they have been surveyed by telescopes of increased power.

It is the opinion of some of our chief astronomers, that the whole firmament of stars visible through our telescopes belongs to the same sidereal system, to which not only our planetary system, but the milky way belong. The general form of this vast sidereal system may be rudely described as a layer cleft to a considerable extent at one end, and twisted, as well as sending off processes, in other places. In some directions, it is thought that our telescopes do not reach the boundary of it, in others they see into the space beyond.

WOOD-PLANING MACHINE.

By Messrs. John M'Dowall & Sons, Johnstone, Renfrewshire.

PLANING machines for timber, as we have already endeavoured to show,* owe much to the inventive talent and constructive skill of Mr. M'Dowall, who, by directing his attention almost exclusively to wood-working machinery, has largely contributed to the advancement of a class of mechanical contrivances which would otherwise have run some risk of falling behind in the course of the general industrial improvements of the age. The improvements which we now bring forward comprehend a newly-arranged planing machine, with a silent feed motion of differential action—a "silent feed motion" for sawing machinery—and a new arrangement of combined roughing and finishing cutters for "thicknessing."

Fig. 1, in the plate, is a complete longitudinal elevation of the improved planing machine, as in working order, with a board in the act of passing through it to be planed. Fig. 2 is a corresponding plan of the machine. The entire apparatus is carried upon the long main vertical side standards, A, cast in suitable lengths, and bolted down to the foundation by lugs, as at B. These frames are connected together by transverse end-pieces and tie-rods, to form a strong rectangular carrying-frame; and at one end of it is the first motion driving shaft, C, shown as broken away from its actuating power. This shaft has an inner end-bearing in one of the side standards, and it carries the large first motion-strap pulley, D, giving motion to the whole of the cutting movements. From this pulley, a broad open strap, E, passes to a small pulley, F, on the outer end of a cross shaft, G, running in bearing brackets, H, bolted to the framing at the opposite end of the machine. This shaft also carries an outside pulley, I, from which a crossed strap, J, passes back to a small pulley, K, on the shaft of the compound rotatory planing cutter, L, for planing the upper surface of the board or flooring deal, M. The spindle of this cutter is carried in vertically adjustable end-bearings, N, fitted to the vertical edges of the bracket standards, O, which are bolted down on the upper edges of the main framing pieces. The cross shaft, G, also carries a pair of equal-sized strap pulleys, P, whence twisted straps, Q, pass to the two broad pulleys, R, on the vertical spindles of the two cutter heads, S, which cut the edges of the wood, and, if necessary, tongue and groove them. These two latter cutter-spindles are carried in bearings, T, on horizontal dovetail slide-pieces, U, adjustable at different distances on each side the longitudinal centre of the machine, by the action of two screw-spindles, one of which is actuated by the outside hand-wheel, V, whilst the other spindle, which is only to be shifted occasionally, is adjustable by a key, to be shipped on to the square head, W, on the opposite side of the machine. The front spindle carries a fine pitched worm, X, in gear with a horizontal worm-wheel, Y, fast on the spindle of a small index-hand, which points to a graduated arc, Z, and thus indicates the exact "set" of the cutters for the particular breadth of timber under treatment.

As the deal is passed into the machine to be planed, it is first of all entered beneath the nipping feed-cams, *a*, which carry it continuously forward to the cut. Each nipping arrangement consists of a horizontal traversing plate of metal, *b*, tongued at its opposite ends, to slide freely but accurately in corresponding grooves in the top plates, *c*, of the standards; and upon these plates, *c*, are attached a pair of vertical parallel standards, *d*, connected at their upper ends by a light cross bar, *e*, which answers as well for the bearings of the overhead cross adjusting spindle, *f*, for the "set" of the nippers. Each standard, *d*, is slotted down its centre, to receive and guide the traversing nut-bearings, *g*, of the cross cam-spindle, *h*, a screw-spindle, *i*, being passed down from above, and through the nuts, *g*, so as to enable the cam-spindles, *h*, to be set up or down by the screw action. This screw action is worked, when necessary, by handles shipped on to the end of the cross spindle, *f*, by the workman, who thus works the screws, simultaneously through the two pairs of small bevil-wheels, *j*. Each cam-spindle, *h*, has an eccentric cam, *a*, loosely hung upon it by an eye, the cam-eye being entered upon the spindle up against an adjustable collar, *k*, on the latter; and the cam-spindle, *h*, is set fast in the standard slots by the outside adjusting-nut, *l*. Thus arranged, the nipper forms a complete traversing frame, capable of free horizontal movement along its guide grooves. Beneath the level of its traverse support, two projecting eye-pieces, *m*, are cast on the plate, *b*, each eye carrying a joint stud, *n*, whence short links, *o*, pass to corresponding eyes, *p*, on the upper ends of the two sides of the vibrating lever frame-piece, *q*. Each frame is carried on a stud centre, *r*, in the framing, and each has a bottom joint-eye, *s*, for connection, by a link-rod, *t*, to the actuating cam-feed mechanism at the front or entering end of the machine. Each frame has also a heavily-weighted bent lever, *u*, attached to its bottom cross bar, and contrived so as to tend to draw the frame continually backward in the opposite direction to the traverse of the wood.

The primary movement is given to the entire series of these nipping feeders—of which there are six altogether, three being at each end of the machine—by a toothed pinion, *v*, on the first motion shaft. This pinion gears with a large toothed wheel, *w*, set on a cross shaft, *x*, and carrying a second pinion, *y*, in gear with a second spur-wheel, *z*, fast on the actuating cam-shaft, 4. On this shaft are keyed the three separate cams, or differential eccentric pieces, 1, 2, 3. Opposite to, and over the periphery of each cam, is set an antifriction pulley, 5, carried on the horizontal arm of a bell-crank lever, 6, the three bell-cranks being carried loosely on a stud shaft, 7. The longer vertical arms of these bell-cranks are connected by eyes, 8, at their lower ends to the respective rods, 6, which are severally linked, as already described, by end and intermediate eyes, to the bottom of each of the nipping frames. The three cams are so set at starting, that they shall each act at different periods of the revolution of their carrying shaft, in such a manner that a uniform feed action may be given to the board passing through the machine. In other terms, they are set at equal distances asunder in the direction of the revolution of their shaft, each cam being linked to and made to actuate two nippers. Thus, the corresponding nippers of each pair have always the same relative position, as marked 1, 2, and 3. Then, as the planing goes on, and the cams revolve, each pair of nippers is made to traverse forward—say in the direction of the arrows at 1—by the upward revolving action of the corresponding cam. This forward traverse is the positive feed action; for the moment the nipping frame moves in this direction, the prominent eccentric portions of the cams, *a*, 1, are thereby carried down, or jammed hard upon the upper surface of the timber, squeezing it firm down upon the bottom plates, *b*, so that the timber is carried forward to the cut, as if it were permanently attached to the nipping feed-frame. Whilst this positive feed is being given to the wood, the two pairs, 2, of the nippers are being brought back by the action of their weighted levers, as their corresponding cam is descending in its revolution; these two nippers are consequently slipping over the wood, for, on the instant of the return movement towards the entering end of the machine, the prominences of the nipping cams are drawn out of nipping contact, and the frames go back without interfering with the feed traverse of the wood in the forward direction. As delineated in the plate, the third pair of nippers are still in forward gear, and acting, by reason of the position of their actuating cams, to carry forward the wood in concert with the nippers, 1. By this means, as each cam comes round, it gives its forward feed and back traverse in regular uniform succession, each succeeding nipper gradually relieving the last in feeding action. And although two nippers always thus tend to come into action at the same time, derangement cannot ensue from this cause, inasmuch as the quickest forward feeding nippers at any given moment carry forward the wood free of the other nippers, which give way in their nipping action to the higher rate of motion, by reason of the consequent slip or disengagement of the nipping cam. In this way the feed is constantly uniform, as although it is furnished by three separate actions, yet each only comes into actual feeding play at the moment that it is required to keep up the regularity of movement.

As the board is thus carried forward, it comes first above the three finishing planes in the frame, 9, over which it is held down by the three rollers, 10, which run in adjustable bearings held down by the helical springs, 11, adjustable to any desired tensional pressure by the nuts, 12, on their screwed spindles, 13, carried in the stationary frames, 14. After passing these pressers, the emerging end of the wood, as planed and finished on its under surface, proceeds beneath the duplex pressing pulleys, 15, set on a stud centre in the free end of a lever arm, 16, fast to the horizontal shaft, 17, carried in end bearings, 18, in the end frame, and held down by the lever and weight, 19. Thence it enters beneath the pair of horizontal pressing rollers, 20, similarly held down by adjustable helices, 21; and it is between these two rollers that the planing of the upper surface takes place. At the moment, however, of its passage beneath the duplex pulley, 15, it is first acted upon by the two cutting heads, S. In the present example these cutters are arranged for tongueing and grooving the opposite edges of the flooring deal, as is usual in laying flooring. Thus, in the elevation, fig. 1, the two square cutters, 22, take off the two angles of one edge of the deal, leaving the central feather or tongue standing up, whilst the other double angular single cutter, 23, takes off the sharp angles from the tongue. Again the opposite cutter head, for the other side, carries three plain central grooving cutters, 24, for producing the plain groove, whilst a fourth duplex cutter, 25, is added, to shave off the angular edges in a similar way. This completes the edge finish of the board, and the latter then being held well down by the rollers, 20, is submitted to the action of the rotatory cutter, or "thicknesser," L, for bringing the upper side of the wood to a fair level, and equalizing the thickness of the deal.

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* Plates 42 and 44, Vol. II., *Practical Mechanic's Journal.*

Fig. 3.

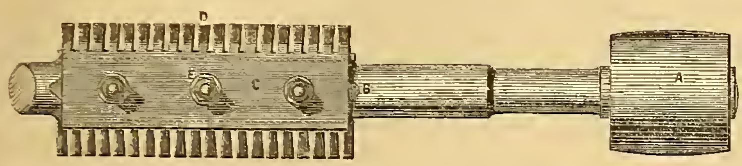
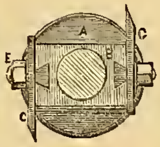


Fig. 4.



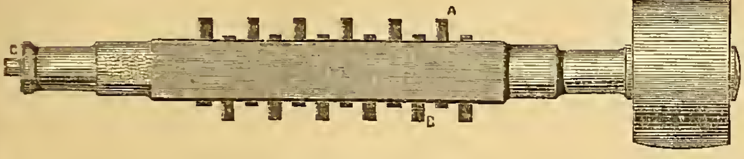


Fig. 5.

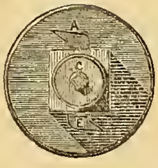


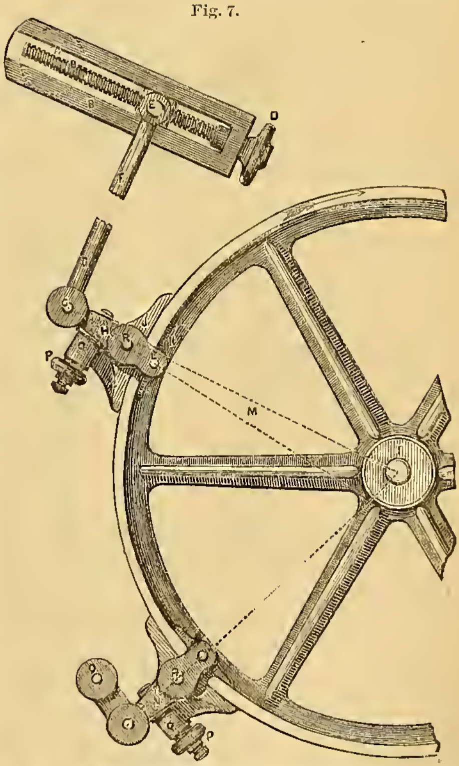
Fig. 6.

The thicknessing cutter, L, in the plate, is a plain rotating blade of the usual kind; but in figs. 3, 4, 5, and 6 of the wood engravings annexed, we have shown two other forms of rotatory cutters of differential action. The first of these cutters both rough-cut and finish at once. Fig. 3 is a longitudinal view, and fig. 4 a cross section of this cutter. It is driven by a band pulley, A, as in the plate, fast on the end of a spindle, with a squared central portion, B, on the two opposite sides of which are set the two cutter plates, C. Each of these plates is cut or slotted out transversely, like a comb, as at D, so as to form a series of regularly disposed cutters; and the two plates being precisely similar, they are so set on the spindle as to "break joint," as it were, in their action upon the deal. In other words, as one cutter comes round, it cuts out a series of strips of wood corresponding to the size and arrangement of the cutting edges; whilst the other, or succeeding cutter, then comes into action, and takes off the prominent strips left by the first one. To make a clean smooth cut, the relative cuts of the two cutters are made to overlap each other slightly in their action. With this arrangement, the whole of the cutting edges may be accurately ground up and sharpened at one operation; and one setting of the plate, by means of the dovetail bolts, E, which pass out from longitudinal dovetail grooves in the spindle, through slots in the plate, sets the whole range of cutters. The cutter represented in the corresponding views, figs. 5 and 6, is a "rougher" only. The spindle is carried in a similar way, but it is slotted clear through its central rectangular portion to receive the alternated roughing cutters, A, B, which are put in in directions reverse to each other, so as to present cutting edges on opposite sides alternately, the series being spaced out by intermediate guage or setting pieces. The spindle is bored out at one end to receive the adjusting binding screw, C, by which the whole of the cutters may be screwed hard up against the solid end of the holding slot. This affords facility of adjustment of the cutters to suit various purposes, and the effect is, that, in working, the cutters remove the overwood or rough surface in shallow strips, so that, when the finishing cutter follows, it makes a clean smooth surface with little difficulty, and there is less liability to tear out large areas of the wood from the surface. After leaving the cutter, L, in the plate, the deal is in its finished state, and it has then simply to be drawn completely through by the nipper arrangement.

In the nipping traverser, or silent feed motion, for sawing purposes, the deal is nipped between two flat clipping pieces of metal, just as it is between the cam and bottom cross plate in the planing machine. These nippers are hinged in pairs to traversing frames, so as to have an alternate angular nipping action and a release movement. These frames are actuated by cranks on shafts, geared together with elliptical spur-wheels, in such manner that the constant uniform revolution of the first motion shaft gives a differential rotation to the actuating cranks, and, through them, to the traversing frames. This plan is particularly well suited for sawing, as the elliptical wheels are so set in reference to the sawing action, that the deal has a slow forward traverse in to cut, whilst the empty nipper returns at a rapid rate, the nipping and slipping actions of the feeders being effected simply by the corresponding traverse and angular position of the two frames.

This feed motion is capable of ready and exact adjustment to suit every variety of circumstances in cutting timber; and the result of this capability is a clear gain of twenty per cent. in the work performed, as compared with that done in a similar space of time by means of former contrivances. This will be understood, on remembering that in saw frames, as usually made, not less than half a tooth of feed change can be made; whilst one-tenth of a tooth might be sufficient for the time being. The "silent feed motion" removes this great defect, by providing for any fractional amount of change of feed, to suit any depth or quality of wood, without occasioning the slightest loss of time in working. Fig. 7 in our wood engravings is a side view of the motion complete. The actuating motion is derived from a rocking-shaft, A, of the usual kind, carrying a slotted lever, B. In the central slot of this lever is a screw-spindle, C, carrying an end hand-wheel, D; so that, by turning this wheel, the nut, E, upon it may be traversed nearer to, or further from, the centre of the shaft, A, and so affect the amount of feed. The nut, E, has jointed to it a connecting-rod, F, the other end of which is jointed at G to the working carriage, H. This carriage embraces the outer and inner parts of the rim of the wheel, I, by means of the palms, J, K; and owing to the peculiar construction and connection of these palms, the upward traverse of the rod, F, places the line of the centres, G, L, at an angle with the neutral radial line, M; thus causing the palms to collapse and nip the wheel rim, and carry it round a portion of a turn, the amount of which is regulated by the working lever, as already described. As the lever, B, descends, the centres, G, L, tend towards the neutral line of action, M, when no movement of the wheel can occur, as the under carriage, N, is at once put into oblique action in the same manner as the upper one—thus resisting any tendency of the wheel to go back, whilst the upper carriage descends to make a fresh stroke. Both carriages are constructed alike. The upper one is represented as advancing the timber; the lower one is fixed at any part of the frame to the stationary centre of the link, O, and is represented as inert, or in neutral action. When the feed motion is to be suspended, to allow the wheel to revolve freely without the occurrence of the nipping action of the palms, the necessary modification is effected by the hand-wheels, P. In each carriage socket, Q, there is a screw, which, on turning the hand-wheel, P, brings the carriage into the neutral line of action, and retains it there; when the wheel, I, may turn freely either way, until the palms are brought back into feeding play by the reverse turning of the wheels, P. The socket, Q, and palm, J, are cast into one piece, and this piece being placed within a holding frame, has a partial rolling motion on the pin, R, as a centre. Between the faces of the socket, Q, and the flat portion of the carriage, as at H, is an india-rubber washer, which, by its elasticity, keeps both parts united, in readiness for instantaneous action, and, at the same time, prevents the faces from being abraided by the frequent impact which occurs in working.

Fig. 7.



This feed motion may be applied to any frame at present in use, as it is immaterial what diameter the feeding wheel may be. It is only necessary that the wheel may be truly turned, internally and externally, and that the palms be well fitted to the turned surfaces.

THE PATENT LAW OF VICTORIA, SOUTH AUSTRALIA.

The Lieutenant-Governor and Legislative Council of this colony, lately issued an act (assented to 31st March, 1854) to regulate grants of patents for inventions, and we now give a summary of its chief provisions.

Any person to whom, as the originator or discoverer of a new invention or improvement in the arts or manufactures, the Lieut.-Governor shall grant letters patent, shall have for the term of fourteen years the exclusive enjoyment and advantage of such invention or improvement, with the same protection, and remedies against infringers, as a patentee in this country enjoys. So much, however, of the Act 5 and 6 Wm. IV. c. 83, as relates to the confirming of letters patent, or granting of new letters patent to a patentee acting under an erroneous belief that he was the first and original inventor, and for the prolongation of letters patent, as well as the several provisions of the 15 and 16 Vict. c. 83, are directed not to be applicable to the colony of Victoria.

The mode of proceeding to obtain a patent is then described, the particulars of which it is unnecessary to explain here, further than to say that £50 must be paid into the government office, and a petition, supported by a declaration, and accompanied by a specification describing the invention, must be presented. Drawings, specimens of ingredients and of the composition, and models, must be sent in along with the specification in cases where the invention admits of illustration by any of these things.

In case of objection to the issuing of the patent, the matter is referred by the Lieut.-Governor to one or more persons for investigation. If the patent is allowed to issue, another sum of £50 must be paid to the Colonial Treasurer. The patent prepared by the Colonial Secretary, signed by the Lieut.-Governor, and sealed with the seal of the colony, must, after its receipt by the patentee, be delivered to the Registrar-General, and it is operative only from the time of such delivery.

Patents are assignable; assignments and licenses must be recorded in the office of the Registrar-General within three months from the execution thereof, and £10 paid.

No person can obtain a patent for an invention which has been previously patented in Great Britain or any other country; but the Lieut.-Governor, on the application of any person being the holder or assignee of a patent granted in Great Britain or any other country, and upon payment to the Colonial Treasurer of £50, has power to grant letters of registration, under the colonial seal, to such holder or assignee. These letters of registration being deposited in the office of the Registrar-General have the same effect as letters patent, so long as the original patent continues in force, but no longer. Before issuing such letters of registration, the Lieut.-Governor will require proof that the applicant is the *bona fide* holder or assignee of the original patent, and that the same is in full force.

The act contains a provision for the correcting of errors in the title or specification, by way of disclaimer or memorandum of alteration. And a provision, that whenever a patent shall be inoperative by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention more than he had a right to claim as new (provided the error arose from inadvertency, accident, or mistake, and without any fraudulent intention), the Lieut.-Governor, upon the surrender of such patent, and the payment of £10 to the Colonial Treasurer, may grant a new patent for the remainder of the original term.

Improvements upon the original invention, made subsequent to the date of the patent, may be protected by having the description thereof officially annexed to the original specification. For this purpose, proceedings must be taken by the patentee similar to those taken in the case of an application for a patent, and £30 must be paid.

A larger number than twelve persons is empowered to have a legal and beneficial interest in a patent. The remaining clauses of the act relate to various points of practice, such as injunctions for infringements, the repeal of patents by *scire facias*, and the enrolment of patents, which do not call for explanation in our pages.

MANUFACTURE OF GUNPOWDER.

A committee appointed by the French Government to examine and report upon a new method of making charcoal for gunpowder, has recently fallen under our notice, and as it may be interesting in these times, we shall lay a translation of it before our readers. There has been a powder manufactory of great celebrity at Esquerdes, in France, for several years. It was formerly conducted by M. Violette,* who adopted a mode of making charcoal by the employment of water heated to a high temperature. The only objection to this process was its great cost. M. Gossart, his successor, conceived that he had discovered a method of obtaining the same result at a great reduction of expense, and it is this method which is reported on by the committee.

The apparatus, say the committee, proposed to be constructed at the powder mill of Esquerdes, is capable of converting about 220 lbs. weight of wood into charcoal at one time.

The water intended to be converted into steam is injected into the body of a pump, the piston of which is loaded with a weight slightly superior to the expansive force of the vapour.

The pressure of the piston forces the water upwards through a series of tubes placed inside one of larger diameter.

These tubes are intended to cool the gases and to condense the vapour after their exit from the carbonising apparatus, the circulation taking place from above, downwards. The cold water contained in the tubes is gradually heated during its ascent, by means of the gas and vapour which pass through the outer tube. It is thereby brought almost to the temperature of ebullition, and is in part converted into vapour in a twisted tube arranged in such a manner as to cover the roof and walls of the furnace.

The water being vaporized in these tubes, is heated to a still higher temperature by being made to pass across bars of metal.

The vapour thus heated is conducted into a reservoir of cast-iron, provided with a thermometer and a manometer to indicate its heat and expansive force. It is then passed into the carbonising apparatus, from which the vapours and gases are conducted along the large tube already mentioned, where the vapour is condensed, and the gas, having been perfectly cooled, is thrown out at the bottom of the apparatus.

The air intended for the support of combustion is heated by passing round a portion of the wall of the chimney, and thus arriving in a heated state under the grate, heat is economised.

The advantages claimed for this system are the following:—

1. Only one furnace is required, in place of two, for the production of the vapour, and the raising it to a high temperature.
2. No more water is subjected to heat than is sufficient to produce the required quantity of vapour.
3. Much of the heat formerly lost is now utilised.
4. The employment of metal furnaces allows a greater heating surface to be obtained, and at a low cost.
5. The production of heat is regular, and the temperature is regular also.
6. The products are capable of being compared one with another.

The arrangement for supplying hot air beneath the grate is a very beneficial one.

Finally, the proposed apparatus is reported to be ingeniously constructed, combining the advantages of economy and regularity in the manufacture of charcoal.

MECHANIC'S LIBRARY.

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RECENT PATENTS.

MINER'S SAFETY LAMP.

Thomas Purdon, *Hull.—Patent dated September* 14, 1854.

Mr. Purdon's object in designing the arrangement secured by this patent, is to give increased safety, and, at the same time, increased illuminating power to the lamps employed in mining operations. In one modification of the improved lamps, the oil for the light is contained in a shallow base chamber, arranged to be screwed, or otherwise attached from beneath, into the bottom of the lantern part; the wick is of the flat thin kind, so as to secure a good clear body of flame, with but little heat. The lantern portion immediately surrounding the light is preferred to consist of a rectangular frame, the vertical pieces of which are grooved out to receive the window pieces, which are passed in as slides. These window pieces consist of a central sheet of glass, defended by an outer and an inner sheet of talc; thus forming a compound diaphragm of great strength. When the sheets of talc are laid upon the glass, copal varnish or other transparent matter is introduced between the contact surfaces. This interposed matter binds the three sheets together, and it dries near the edge, whilst it remains fluid, or partially so, towards the centre. The talc defends the glass from accidental fracture, and if the central glass sheet should be broken, the interposed varnish, entering the cracks, strengthens the injured part. The lantern portion of the lamp is covered in by a slightly convex metallic disc, forming the base of a tall and narrow perforated cylinder or chimney; this disc being of use in preventing injury from the fall of water. The base of the chimney is filled in by fine wire gauze, either in the form of a flat diaphragm or a hollow cone. The chimney is coarsely perforated, and is of stout metal. It is surmounted by an elevated open cover piece, with a suspension ring at the top. The lamp may either be carried by this ring, or grasped by the perforated chimney, the great area of which prevents the occurrence of intense heat. One of the sides of the lantern portion is fitted with a reflector, behind which there is no glass, the space being filled up by two wire gauze diaphragms, with a non-conducting air space between them.

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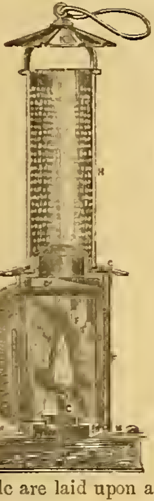
* See articles on M. Violette's steam preparation of wood, vol. i. p. 106, and vol. ii. p. 95.



Our engraving represents the lamp in vertical section. The oil for the light is contained in the shallow base chamber, A, which is screwed, or otherwise attached from beneath, to the bottom, B, of the lantern part. The wick, C, is of the double flat thin kind, so as to secure a good clear body of flame, with but little heat. It is fitted into an ordinary flat wick-holder, which is secured in the usual manner to the top of the oil pan, A. The lantern portion of the lamp consists of a rectangular metal frame, the vertical supports, D, of which are secured by rivets to the top plate, D′, of the lantern, and may each be formed out of a single piece of tin plate, or sheet brass, which is so doubled or shaped as to present two lateral grooves at right angles to each other. These grooves serve to contain the wire gauze frame, E, and the window pieces, F F, of the lantern, which are fitted into them from above, before the upper or chimney part of the lamp is put in its place, being secured, and made perfectly close by means of plaster of Paris, or other material in the form of cement. The window pieces consist each of a central sheet of glass, defended by an outer and an inner sheet of talc, thus forming a compound transparent diaphragm of great strength. The sheets of talc are laid upon and secured to the sides of the glass by copal varnish, or other suitable transparent material. The lantern portion of the lamp is covered in by a slightly convex metallic disc, G, forming the base of the tall and narrow perforated cylinder, or chimney, H, which is screwed at I to the top plate, D′, of the lantern part of the lamp, and fixed by a small punching screw. The disc, G, serves to protect the lantern portion of the lamp from injury by the falling of water. The base of the chimney is filled by two diaphragms of fine wire gauze, either in the form of flat discs or of hollow cones, or both combined, a non-conducting air space being left between such diaphragms. The chimney, H, is coarsely perforated, and is of stout metal; it is surmounted by an elevated open cover piece, K, with a suspension ring at the top. On the wire gauze side, E, of the lantern, is fitted a reflector, L, for the purpose of increasing the illuminating power of the lamp, and throwing forward the light. The wire gauze side, E, is composed of two diaphragms, as at the base of the chimney, an air space being left between the two diaphragms. By this construction and arrangement of safety lamp, no rush of air can pass through the lamp when being carried, as one square only is open for the admission of air, and that square is placed at the back of the lamp. Another advantage derived from the use of only a small portion of wire gauze is, that as a less amount of air is admitted to the light, any deterioration or want of oxygen in such air will all the more readily have effect upon the flame, and finally extinguish it entirely, when the air becomes so vitiated as to become dangerous. The lamp is locked by a very simple contrivance, the vertical bolt of the lock, which is fixed to the oil pan, taking into a covered slot or hole in the base plate, M, of the lantern. The bolt of the lock, when shot up, enters the covered hole in the plate, M, and, consequently, prevents the oil pan, or base, A, of the lamp from being turned round to unscrew it from the lantern part. As the glasses are fixed in grooves, they can easily be replaced when required, by simply unscrewing the chimney and disc, G.

DRIVING BELTS.

J. Blaikie, *Glasgow.—Patent dated November* 7, 1854.

Smoothness of action, so essential in most kinds of machinery, very much depends on the quality of the driving belts employed, and great difficulty is experienced in obtaining leather of uniform thickness for making such belts, so that any efficient means of producing belts possessing the necessary qualifications, at a comparatively cheap rate, must be considered as a great boon by the machinery-using community of manufacturers. The present invention professes to confer this boon, and merits some attention on that ground, independently of its claims as bringing very simple means to the accomplishment of the desired result. The invention relates to the preparation and manufacture of belts, straps, and bands, such as are used for driving machinery and for other purposes, in such manner as to produce perfect uniformity, as well in the main body of the leather or material employed as at the junctions, where the overlapping of the ends is effected. The leather or other material to be used in the manufacture of the belt or band is first passed through a machine for the purpose of equalizing its thickness, by shaving or slicing off the superfluous material wherever such superfluity may exist. This machine consists of a rectangular frame, having at one end a roller or guage-piece capable of being set up at a greater or less distance from a stationary cutter or knife. The band to be treated is entered by one end between the cutter or knife and the roller or guage-piece, and it is then forcibly drawn through between these contiguous surfaces by a pulley or other suitable action. This treatment causes the cutter or knife to slice off all the superfluous material, and bring the band down to the requisite thickness and uniformity. After this process, the band or piece of leather is passed through a somewhat similar machine, or through the same machine suitably arranged, for the purpose of bevilling the junction ends of the leather. To accomplish this action, the thicknessing roller or guage-piece, which is set parallel with the knife, is carried upon the ends of the shorter arms of two curved or inclined levers set on fixed studs in the machine framing. The band is then drawn through as before between the cutter and its guage-piece or roller, this tractive action being conveniently effected by a rack and pinion movement driving the holding clamp for the end of the band. This traversing holder carries adjustable stud-pins made to bear on the upper sides of the longer arms of the lever or levers with which the cutter roller or guage-piece is connected. Hence, as the traverse goes on, and the leather is drawn through the adjustable studs upon the traverse, details bear down upon the shaping levers, and cause the roller or guage-piece to gradually approach the cutting edge, and thus cause the cutter to make an inclined or bevilled slice. The bevilled ends of such bands may be joined together for use, either by cement or stitching, or in any other convenient manner. Bands or belts made in this way are perfectly uniform in thickness, and they are for this reason far more effective in action than bands of the common kind.

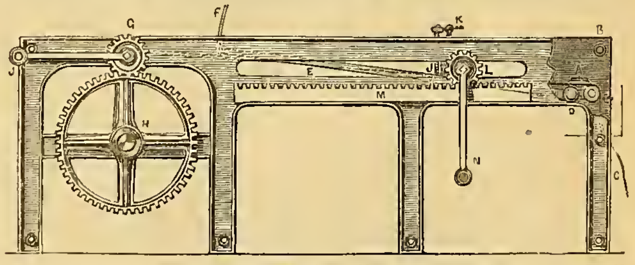


Fig. 1 of our engravings is a side elevation of the improved machine for equalizing the thickness of belts for machinery. The details of the machine are carried in a framing consisting of a pair of parallel cast-iron side standards, connected together by tension rods. The knife, A, by means of which the belt is reduced to the required uniform thickness, is situated close to the end, B, of the frame, and it is fixed by having its two ends entered into slots in the side standards, being accurately adjusted by means of external pinching screws. The edge of the knife is towards the end, B, of the machine, and the belt, C, to be operated upon passes under it and between it and a roller carried in eyes in the ends of two short levers fast on a transverse spindle, D, turning in eyes in the side standards; and this spindle has also formed or fixed upon it a long lever, E, which has a graduated segment, F, formed on its outer end. By raising or lowering the lever, F, the guide roller is made to recede from or approach the cutting edge of the knife, A, and by so doing the thickness to which the belt is to be reduced is accurately determined, the graduated segment, F, serving as an index, by which the position of the roller is regulated.

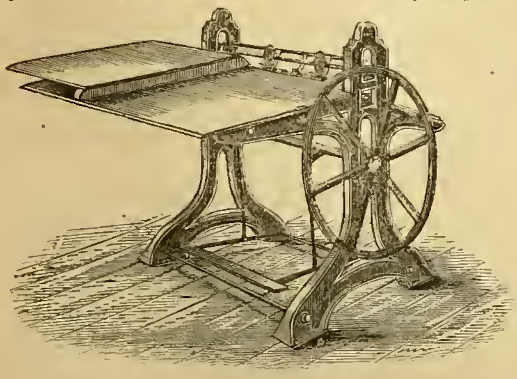
The belt, C, is stretched upon the surface of the roller, so as to be presented to the knife edge in a uniform tight manner, by means of a bar capable of adjustment to suit the thickness of the belt under treatment. After passing under the knife, A, the belt, C, passes on over the driving-spindle at G, and thence to the winding-up barrel at H. The spindle of this barrel has keyed upon it a spur-wheel in gear with a pinion fast on the spindle, G, upon which is also fixed a winch-handle, I. By turning this handle, the barrel, H, is made to wind up the belt, C, and so draws it through between the roller and the knife, A, and by these means the belt is reduced to a uniform thickness, the knife taking off all the material of the belt which exceeds the thickness for which the apparatus is set.

Arrangements are provided in the same machine for bevilling or tapering the junction ends of the belt. This bevilling is effected by causing the guide-roller to gradually approach the knife, A, as the belt is drawn through the machine. When the end of the belt is to be bevilled, it is not drawn through the machine by the barrel, H, but is held between a bar, J, which is capable of sliding in slots in the side standards, and an adjustable clamp-piece, linked to an upper bar, which is adjusted upon the bar, J, by means of a screw, K, so as to draw the clamp up against the under side of the bar, and nip the belt between itself and the bar. A transverse horizontal spindle is arranged to work in eyes formed on the ends of the bar, J, and passing through the slots in the side standards, has pinions, L, fixed on its overhanging ends, these pinions being in gear with horizontal racks, M, bolted to the side standards. A winch-handle, N, is fixed on one end of the spindle, and by turning it, the bar, J, will be made to traverse along the slots, in consequence of the action of the pinions, L, on the racks, M. At the part of the bar, J, which is immediately over the lever, E, is a screw-pin, which, as the bar, J, traverses away from the end, B, of the machine, gradually depresses the lever, E. By these means, as the end of the belt is being drawn between the knife, A, and the guide-roller, the latter is made to gradually approach the knife, which, consequently, cuts more and more deeply into the material, finally getting quite through it, and producing a regularly-formed bevil upon the end of the belt. The length of the bevil or inclined portion of the belt is regulated by adjusting the screw-pin in the bar, J, so as to commence its action on the lever, E, at a point nearer to, or further from, its centre of oscillation. The length of the bevil is also determined by means of a guage-piece, O, at the end, B, of the machine, being held in an adjustable socket-piece screwed to one of the tension bars of the frame. The guage, O, is set at a distance from the knife edge, A, corresponding to the length of bevil to be given to the end of the belt, and the belt is introduced in such a manner that its extreme end will just reach the guage, O, at the commencement of the bevilling action.

PAPER PERFORATOR.

W. & H. H. Bemrose, *Derby.—Patent dated December* 11, 1854.

The subject of this invention is a machine for perforating tickets, labels, cheques, and papers of various descriptions, in order to facilitate their separation from each other, or from the books in which they are made up. The arrangement of the machine is very simple; the paper to be perforated is passed beneath any convenient number of rotating wheels furnished with punches or cutting points on their peripheries. These perforating wheels are made to revolve at the same surface velocity as that of the paper passing beneath, the paper being drawn through by the nipping action of the perforating wheels and of counter-pressure rollers beneath. Our engraving represents a perspective elevation of the machine. The framing consists of two cast-iron side standards, connected by tie rods, and formed with brackets, to receive two boards, one on each side, a horizontal one on the front side where the paper is introduced, and an inclined one at the back, so that the perforated paper may slide off out of the way. The perforating wheels and counter-pressure rollers are carried upon parallel horizontal spindles, which are geared together, and are driven by a belt and pulleys from a crank shaft, worked by a treadle, and fitted with a heavy fly-wheel. The perforating wheels and counter-pressure rollers are adjustable upon their spindles, so that they can be set at any distance apart to suit the lines of perforations required. The perforations may be formed by hollow punches, fixed on the peripheries of the wheels, or by knife edges, and the counter-pressure rollers are formed with a series of holes, or a slit round their peripheries, into which the perforating points or punches enter. The paper is prevented from adhering to and being carried round by the perforating wheels by fixed wires at the back of the wheels, the free points of the wires lying in grooves in the wheels, and, being above the paper, so as to prevent its rising up when perforated. Any number of wheels may be fitted upon the spindle, according to the number of perforated lines required upon the paper. When the lines of perforations are required to cross each other, as in sheets of postage stamps, the perforation is effected at two operations.



Our readers will doubtless have experienced that the sheets of postage stamps now in use are not quite so ready to tear through the lines of perforations as might be expected. In fact, unless the tearing pull is given pretty accurately, the tear will take place across the unperforated portions. This defect arises from the system of punching adopted, and from the shape of the perforations, which are circular. The punching action hardens the edge of the paper round the hole, and the portion between two holes, that is, in the line of the perforations, is made harder than the sides, from the nearness of the holes, so that the paper is actually weaker and more apt to tear at the sides than in the line of the perforations.

Messrs. Bemrose's work is a great improvement upon this. In a sample we have before us, the perforations are elongated slits, no paper being actually removed, as with a common punch. The edges of the slits are not hardened, and these being elongated, the tear is sure to take place through them, however carelessly the pull for effecting it may be given.

ANVILS.

L. Kirkup, *Newcastle-upon-Tyne.—Patent dated November* 14, 1854.

According to the ordinary system of manufacturing smiths' anvils, these articles are made by combining together seven different pieces of metal—namely, the core or body part, the four corner pieces which serve to enlarge its base, and the two pieces to form the projecting ears. The core is first formed, and the remaining six pieces are then welded to it, and the whole is hammered to bring it to a uniform condition. Instead of adopting this mode of proceeding, Mr. Kirkup forges the anvil out of a single piece of metal, and afterwards case-hardens the whole. By this means the anvil may be made both cheaper and larger, without any necessity for welding steel to iron. The upper surface is made larger in area, but smaller in depth, than ordinarily, and is supported upon a hollow truncated pyramid, either round or rectangular, and composed of cast-metal or other suitable substance. Fig. 1 of our engravings is a side elevation of an anvil constructed according to the improved system, and as mounted upon its support. Fig. 2 contains a side and two end elevations of the anvil as detached from its support. The anvil is forged with a downward projecting portion or neck, A, upon its under side, and this neck fits into a corresponding aperture in the hollow cast-iron pyramidal supporting block, B. Holes, C, are formed vertically through one of the ears of the anvil, as in the common anvil, for the purpose of receiving the cutting tools employed by forgers. The dovetailed grooves, D, serve to hold swage blocks, of any desired form, when required.

Fig. 1.

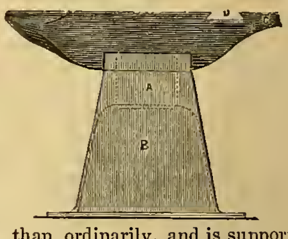
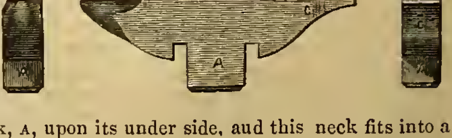


Fig. 2.



FLUID-MEASURING GLASSES.

H. Hudson, *South Shields.—Patent dated September* 21, 1854.

Great difficulty is experienced in graduating glass fluid measures made according to the ordinary system, on account of the variations in the capacities of the individual glasses, which, according to that system, it is almost impossible to avoid. Mr. Hudson, however, has completely vanquished this difficulty, by devising a means of making the glasses accurately to one pattern, so that one scale of graduations will serve for all the glasses made by the same apparatus. This result is obtained by moulding or shaping the glass measures by means of pressure. In making a bell or trumpet-mouthed vessel or cup of this class, such as is universally used by retail druggists, for example, a divided mould, which, when closed, presents an internal section corresponding to the external section of the intended measure, is used. Into this mould the required amount of "metal" or melted glass is dropped in the usual way, and the extremity of a plunger, which corresponds to the interior of the measure, is then brought down by a press action to mould or shape the measure by a single movement. The plunger is then withdrawn, when the moulded vessel may be taken out by opening the mould in the usual way. An air-pump may be used to exhaust the air from the mould, so as to render the moulding much more accurate than if bubbles were allowed to form. Solid or undivided moulds may obviously be used for measures which can be extricated clear off from such a mould, by reason of their having no "undercut" or projecting portions. But, with the divided mould, the press will form the measures with their feet or bases complete, as well as with their spouts and flanges. The graduations of these measures may also be made at the time of moulding, so as to turn out the measure in a complete state. In moulding the foot of the measure, it is preferred to shape it in the actual mould to an inverted cup form, as the glass is moulded sharper in this way. This cup is afterwards heated on removal from the mould, and opened out to the shape desired. Each size of measure has, of course, its own mould, contrived to form a measure to a given standard with perfect accuracy. Thus, any number of copies of a measure may be found all equally correct, the irregularities inseparable from the manual process being completely obviated.

Fig. 1.

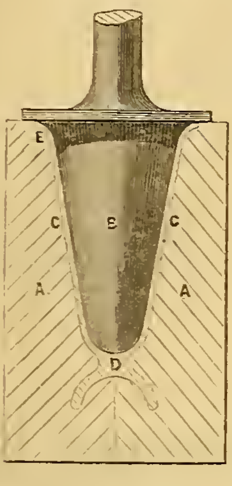


Fig. 2

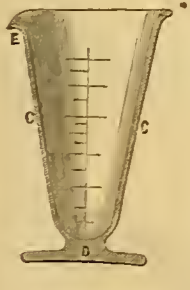


Fig. 1 of our engravings is a vertical section of a plunger and mould in the act of forming a glass measure, and fig. 2 is a vertical section of the finished measure. A divided mould, A, of cast-iron, or other suitable material, is used, the interior of such mould corresponding to the exterior of the measure. The glass is shaped by a plunger, E, connected with a press of any convenient kind, which plunger corresponds exactly in size and shape with the interior of the measure to be formed, the glass, C, in the mould being the material of which the measure is being formed. The mould in the figure is represented as being made in two pieces, and opening down the middle, as the undercut formed by the foot, D, of the measure would effectually prevent its removal from the mould if the latter were not divided. It is preferred to make the foot of the measure in the mould in the form of an inverted cup, as shown in fig. 1, whereby a sharper moulding is obtained than if the foot were moulded flat. When the measure is taken out of the mould, this cup portion is heated and opened out to the shape desired, as shown in fig. 2. The spout, E, of the measure is formed either by the action of the plunger and mould, as shown in fig. 1, or it may be formed afterwards by hand, when the measure is in a heated state. The graduations of the measure may be made during the time of moulding, by having corresponding slight recesses made in the mould, but it is preferred to cut the graduations in the measure in the ordinary manner, after it has been shaped in the mould.

METAL PLATE SHEARING APPARATUS.

Jabez Morgan, *Kidderminster.—Patent dated October* 28, 1854.

This patent covers several modifications of shearing apparatus for cutting boiler plates and other metallic sheets. The chief improvements in these machines consist in the increased simplicity and compactness of their arrangement, and in the application of means of adjustment, whereby increased accuracy is secured. In one form of the apparatus, the upper blade works on a fixed centre at one end of the blade, and above the level of the cutting edge. The blade is fitted at one end upon a screwed spindle, which works through a fixed portion of the standard, and is so arranged that, by unscrewing slightly the spindle forming the working centre of the blade, the latter with its steeled cutting edge will be brought close up against the lower cutting edge, thereby rendering the machine more accurate in its work. When adjusted, the spindle is tightened up by a screw nut and cutter; a cutter or wedge may also be employed to adjust the blade, the cutter passing through the spindle, which will not, in this case, be screwed into the standard. The free end of the blade works in a fixed guide or groove, and is tightened up by a metal strip and adjusting screws. An eccentric or crank is employed for actuating the blade, and works in a slot or recess in the blade. The shaft which carries the eccentric cam or crank is entirely out of the way of the plates when being put through the machine, and is carried inside one of the end standards, and works at right angles to the blade, the eccentric cam or crank being at the end of the shaft. Another improvement consists in the application of a table, moveable at pleasure, behind the lower cutting edge, for the purpose of supporting the plate or scraps when a long length is being passed through the machine. This table may be removed when short pieces are to be cut, to allow them to fall in a heap behind the machine, whence they may be afterwards removed in the ordinary manner. Another improvement consists in the employment of a guage piece, fitted to a fixed part of the standards behind the cutting edges. This guage is adjustable to any width, and enables a perfectly straight cut to be effected. Another improvement consists in cutting out or recessing the end standards of the machine, whereby a plate of any length may be cut by simply passing it through the machine, the recesses before referred to admitting of such plate being passed under the blade. According to another modification of the apparatus, the blade is made to work in vertical slides on the front or insides of the end standards, and is actuated by eccentrics, cams, or cranks, below the cutting edge, such eccentrics, cams, or cranks being made to work in slots or recesses in the bottom of a vertical frame, forming one piece with the blade. This frame may either be outside or inside the main standards. The table and guage are also applied in this last described arrangement, and the standards are also cut away to admit of a plate being passed through the machine lengthwise.

Fig. 1.

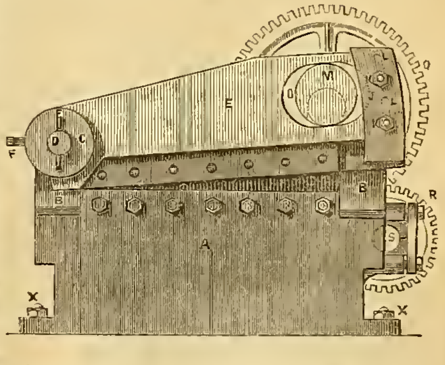


Fig. 1 of our engravings represents a front elevation of one modification of the shearing machinery. The cast-iron framing or standard, A, is cast in one piece, and formed with openings or recesses, B, at each side, for the purpose of admitting of the plate which is to be cut being passed through the machine. A strong boss, C, is cast on one side of the standard or framing, and through this boss is passed the pin or spindle, D, which serves as the working centre of the upper blade, E. This spindle may be fixed and tightened up to any extent by means of the cutters, F, one being passed through the spindle, D, at each end, and a third one through the boss, C, and the centre of the spindle. By this arrangement, it is obvious that the upper blade may be adjusted with the greatest accuracy in relation to the lower cutting edge or "steeling," which is screwed to the inner face of the front plate of the framing; the upper edge of such plate being recessed slightly to present a firm and steady bearing or support to the steeling. The lower edge of the upper blade is similarly recessed to receive the upper steeling, H, which is also secured by screws; the heads of the screws of both steelings next the cutting sides being countersunk. The free end of the upper or working blade is guided and kept close up against a face plate cast on the standards, by means of the plate, J, and adjusting or tightening bolts, K, which pass through the standards, and through curved slots, L, in the blade, and finally protrude through the plate, J, where they are secured by nuts. The upper blade is actuated by an eccentric, M, which is cast on the end of the driving shaft, and works in a slot or recess, O, formed in the body of the blade. The shaft works in suitable plummer blocks, cast on the inside of the framing, and has keyed on it at one end the spur-wheel, Q, which is driven by the pinion, R, fast on the main driving shaft, S. In order to support the plate or portion which is being severed whilst passing through the machine, a table is placed behind the lower steeling, and is supported at its ends by resting upon the recessed portion of the framing. When short scraps are to be cut, the table is removed, and the scraps then fall down in a heap on the bottom of the machine, whence they are subsequently removed. The whole machine is bolted down to a firm foundation by long bolts and nuts at X. Fig. 2 represents a longitudinal vertical section of another modification of shearing machine, the front or face plate being removed for the purpose of showing more clearly the arrangement for actuating the working blade. The framing, A, is cast in two pieces, and is recessed at the ends at B. The lower steeling is also secured to the face or front plate of the framing, as described in reference to fig. 1. The upper blade, D, with its steeling, E, works in slides at F, formed in the face of the machine framing. This blade is cast in one piece with the rib, O, and the open cam or eccentric chamber, H, in which chamber work a pair of cams or eccentrics, I, fast on the main driving shaft. This shaft may be the driving shaft of a set of rolling mills, the shearing machine being placed at one end of the set of mills, and the eccentrics, I, fitted upon the end of the driving shaft. This shaft works in bearings fitted into the front and back plates of the framing. A square boss is cast thereon at those parts, for the purpose of uniting the two halves of the frame, which is effected by two strong bolts passed transversely through each boss, one above and the other below the bearing of the driving shaft. The rib or framing, O, is guided in its vertical traverse by the upper and lower guide spindles, M and N, the upper one, M, being cast on the top of the rib, and the lower one, N, on the under side of the cam chamber, H. These two guide spindles work through bushes fitted between the two halves of the square bosses, O, cast on the top and bottom of the standard, and fastened together by transverse bolts. It will thus be obvious, that when the driving shaft revolves, the eccentrics thereon will impart a vertical traverse to the upper blade, and effect the cut required. The moveable table mentioned with reference to the first described machine, is also applied to this second machine, as also the adjustable guage bar. Fig. 3 represents a front elevation of a modified arrangement of the machine represented in fig. 1, and differs from that one in being actuated by two eccentrics, A, employed for working the blade, B, such blade having a vertical movement communicated to it in place of working on a fixed centre at one end, as hereinbefore described. The eccentrics, A, are cast on the ends of the shafts, C, and work in two slots or recesses, D, formed in the blade, B. The shafts, C, work in suitable bearings cast on the inside of the standard or framing, E, and are fitted at their back ends with spur-wheels, F, which wheels gear together, and receive motion from the pinion, G, fast on the driving shaft, H. The upper blade works in slides formed for that purpose in the face of the standard, and is kept therein by the cover plate, J, which is bolted or screwed upon the front of the standard. The arrangement and mode of fixing the upper and lower steeling, K and L, is precisely similar to that already described with reference to fig. 2. The moveable table and guage plate are applied in the same manner as in the other modifications. By the arrangement last described, the blade, B, will have a vertical parallel motion communicated to it, each end of the blade ascending or descending simultaneously by the action of the eccentrics. The adjustment of the working blades of the two arrangements, shown in figs. 2 and 3, may be effected by having suitable adjusting strips inside the front cover plates, J, to be tightened up either by screws or cutters.

Fig. 2.

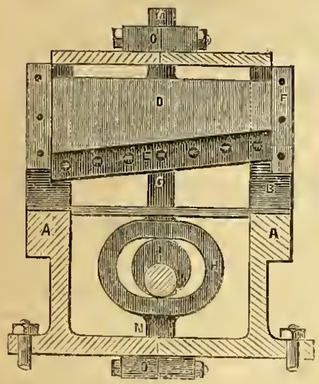
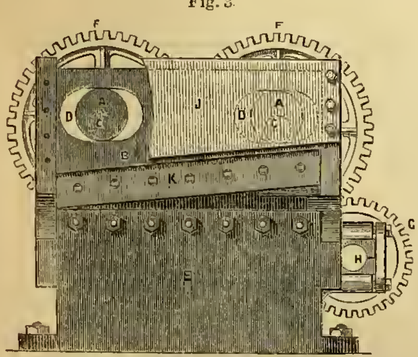


Fig. 3.



FIREPROOF BUILDINGS.

W. B. WILKINSON, *Newcastle-on-Tyne.—Patent dated October* 27, 1854.

Mr. Wilkinson's invention relates to a mode of constructing the floors, ceilings, roofs, partition-walls, and staircases of buildings, so as to render them fireproof—a property, the necessity of which has been so fully demonstrated by the recent conflagration at the town where the inventor resides.

Fig. 1.

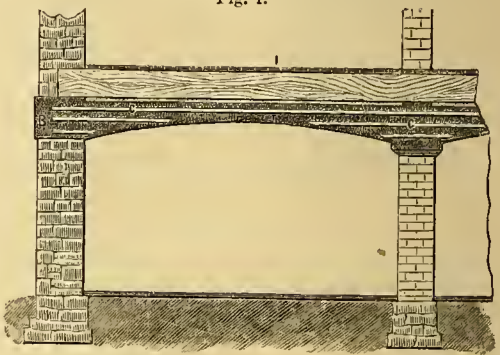


Fig. 2.

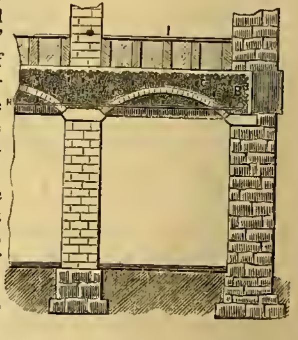


Fig. 1 of our engravings is a longitudinal section, and fig. 2 is a transverse section of a warehouse floor, as constructed according to the improved system. In constructing the floors of dwelling houses or warehouses formed during the progress of the building with ceilings of an arched form, the walls of the building are carried up to the requisite height for the first floor, B. A centering is then firmly fixed over the whole area intended to be floored, and is boarded with narrow strips, with small spaces between each, and very slightly nailed to keep them in position. The material to form the floor and ceiling is composed of crushed bricks, metallic scoria, and other hard substances (which, however, must be free from soil or other extraneous matter), and Portland or other cement of equal quality. These materials may be mixed together in the proportion of—three parts of crushed hard-burnt bricks and scoria, sifted thro' a riddle of about two-inch mesh; one part of hammer-broken stones or bricks or other hard substances reduced to about the size of two inches diameter; one part of the same material, hammer-broken and reduced to about the size of a quarter brick. The whole is then well incorporated; the three parts of two-inch scoria and burnt bricks are then mixed with water, to which are afterwards added two parts of the coarser material, and the whole is well worked together with the cement to produce perfect cohesion. This mixture, when ready, is thrown upon the centering and beaten in solid, the coarser portions in the haunches, and the finer parts towards the crown of the arch, as the larger portions of the broken bricks would not lie conveniently over the crown of the arch, where the thickness is much less than at the haunches. A number of strips, C, of hoop-iron, laid on edge, are imbedded in the mass across the crown of the arch at distances of about two feet asunder, more or less, according to the desired strength of the floor, and so as to reach the full length across the floor or floors, the under edge of the same being set on or near the crown of the centering, so that in this low position the strips may act with more power as tension rods to the floor. The concrete is filled up to the desired level, and if for dwelling-houses or warehouses for the storage of light goods, it may be trowelled smooth and finished in cement, or laid with boards. If a wood floor is desired, strips of wood may be embedded or dovetailed into the cement, to which strips the flooring boards are nailed. When the first floor has been formed, it must be protected from injury by being covered with thin deals laid upon a stratum of sifted sand, which will assist in keeping the concrete moist for a longer period than if it were exposed to the free action of the air, slow drying adding greatly to its strength and durability. The centering should not be removed until the concrete has become sufficiently set, which will be at the expiration of about a month, the walls of the next story having been built in the meantime to act as an abutment to the arch. The rest of the floors, as well as the roof, may be constructed in a similar manner, care being taken to give a sufficient rise to the middle of the roof, to throw off the wet into a channel or gutter at the front and back, or, if preferred, a slated roof may be put on the top in the usual manner. The ceiling of the upper story being of concrete, will effectually prevent the woodwork of the roof, if composed of slate and timber, from taking fire, should the furniture or other combustible matter in the rooms below be consumed. After the removal of the centering, the arched ceiling, if for dwelling-houses, will only require a single setting coat of plastering, and may be decorated with mouldings in a variety of ways, sufficient roughness for which purpose may be given to the arch, by sprinkling over the surface of the wooden centering, before laying on the concrete, a layer of small stones and chips free from dust, part of which will adhere to the concrete, whilst the loose portions may be removed by brooming. The cost of floors constructed according to this system will be very little, if any, greater than that of ordinary wooden floors, and will only be about half the cost of floors constructed according to other modes of fireproof construction. The walls of the building must be carefully built to prevent unequal settlement. The floors formed in the manner described, will admit of brick partitions being set upon them in positions where a wooden floor would not. The stairs may be of stone, or of the same material as the floors, which will be considerably cheaper and quite as good. The skirtings, architraves, and other ornamental details, may be composed of Parian, Keene's, or Martin's cement, so that there will thus be nothing combustible but doors and window-frames, and a fire originating in one apartment can scarcely extend to an adjoining one. In warehouses, the arch and supporting walls are made of additional strength. In cases where ceilings of an arched form may be objected to, and where it may be necessary to execute works with despatch, as in putting in new floors in old buildings, in place of the method described, a flat platform of wood is erected to the ceiling line, and the floor is composed of plaster—air, slacked lime, cut hay, ashes, and breeze, in certain proportions, and old wire rope or iron in other forms in a state of tension, hollow bricks, field drain-pipes, coke in lumps, and other similar matters being introduced, if desired, to lessen the weight. The wire rope, H, fig. 2, is secured at its extremities at each line of support, by embedding it in the mixture or concrete whilst the latter is in a soft state, and by forming the ends into loops, or by opening out the strands and spreading them in various directions, thus rendering it so secure that it cannot be drawn out under any force short of the breaking weight of the rope. In ordinary dwelling-houses, it is proposed to place such wire ropes at about nine inches apart, and to have a full depth of floor of 1-16th the span, so that, for a span of 16 feet, the flooring should be 1 foot in depth, the breaking weight of which may be estimated at 2½ tons per superficial yard. Floors of this description may also be constructed at or about the price of ordinary wooden floors. In the construction of warehouse floors for the storage of heavy goods in casks and otherwise, and where a rigid or unyielding floor would be unsuitable, it is proposed to form the surface of the flooring of wood in the usual way, as shown at I. A fireproof counter-floor is erected beneath the boards and joists, a clear space being left between the under side of the joists and the counter-floor, such space, as well as the spaces between the joists, being filled in with dry sand or dry ground gypsum. In case of a fire occurring on a floor so constructed, the flooring deals and the upper part of the joists only can be consumed, as the dry sand or gypsum will close over the joists and extinguish the fire.

In constructing fireproof partitions, and in lieu of the lath and plaster of which these partitions are ordinarily composed, Paris plaster alone is employed, or plaster of Paris and air-slacked lime cast in blocks of a cellular form. The cavities or cells run horizontally, and the blocks are dovetailed together at the joints, and united with strong-guaged plaster of Paris and lime putty, or air-slacked lime. They are set fair, and dressed with scrapers, forming a surface suitable either for paint or paper. This partition may be used on ordinary wooden floors, and is not more heavy or expensive than lath and plaster partitions. In some cases this partition may be supported on a beam composed of wire ropes, plaster, cut hay, and other similar materials. The blocks of Paris plaster, as soon as cast, are embedded into the place intended to receive them with guaged putty and plaster, the floor being previously prepared for them by having a strip of wood or a beam nailed on in the direction of the length of the partition, such strip or beam fitting loosely at its upper edge into grooves in the plaster blocks. The workman having thus laid the first course, cuts a block into two parts, and commences the second course at one end with one of the halves, and then follows up with entire blocks, thus breaking joint with the lower blocks. The door-frames will have a lath or strip nailed up the outside, and the workman with a hand-saw and chisel will form a groove in the ends of the blocks to fit against the strips on the door-frame. The longitudinal cells are particularly well adapted for the insertion of plugs for paintings, and may also be used for ventilation. They also afford facilities for the introduction of pipes for gas or water, and bell wires. The skirting may either be formed on the blocks, or it may be made of plaster or wood after the partition is built.

REVIEWS OF NEW BOOKS.

English Pleasure Carriages. By W. Bridges Adams. Charles Knight. 1838.

Road Progress. By W. Bridges Adams, Engineer. Luxford: Whitefriars' Street, London. 1850.

Construction and Duration of Permanent Way. By W. Bridges Adams, Institution of Civil Engineers. 1851.

Practical Remarks on Railways and Permanent Way. By W. Bridges Adams, Engineer. Wilson: Royal Exchange, London. 1854.

Railway Machinery. By Daniel Kinnear Clark, Engineer. Blackie and Sons: Edinburgh. 1855.

Patent Specifications of Railway Improvements, from 1835 to 1854, of W. Bridges Adams, Engineer, Patent Office, London.

I.

We have grouped the above works together, because the work of Mr. Clark contains the greatest mass of practical ordinary railway progress that exists up to the present time, supplying the hiatus from the time that Booth, Pambour, and Nicholas Wood compiled their various knowledge of the early railway period; and the works of Mr. Adams contain improvements in all branches, Mr. Clark's work containing several compilations from him. We have grouped the works of two men who have laboured *con amore* in their several vocations, after a fashion, for which the common money inducements are scarcely forthcoming, even if money could procure earnest work at that price. The mere love of money can find far better vent in making and in jobbing railways, than it can in earnestly designing, or improving, or reforming them. Nor do we seek unduly to praise men who happen to prefer progress to mere cash. We do not imagine that a man is entitled to more credit, because the Creator has bestowed on him one set of faculties, than another; but we think it always desirable to analyse the mental faculties of any earnest workers, as exhibited in their works; and the more especially when the work is of that character to influence largely the great mass of the community in enlarging the sphere of general happiness. And few of the results of mind have been so largely pregnant with good as the railway system, or perhaps we had better say no system, for it is a question of irregular growth rather than of system—a heap of contrivances to remedy defects, as the defects became apparent one after the other.

When Mr. Clark resolved to write and illustrate a work on railway machinery, he followed the only useful plan of obtaining information, travelling from place to place on railways, and to workshops connected with railways; indeed there were scarcely any books to obtain correct knowledge from, and therefore the things themselves, and not the descriptions of things, were the sources of knowledge to draw from; consequently, the work itself, as it has appeared in parts, has not seemed systematic. Containing large amounts of valuable information, we can yet imagine that Mr. Clark would desire nothing better than to redigest it. We have, for example, locomotives and carriages and engines of all kinds in the early numbers, commencing with an engine by Fairbairn for the narrow guage, followed by a six-wheel first-class carriage of the Great Western, but with no critical remarks—now the book is finished—of what may be bad or good in the latter; and then the letterpress commences with an "Historical Progress of the Locomotive," the first woodcut being Murdoch's model engine, going on to the Manchester experiments with the Rocket, Sanspareil, and Novelty, and so on from 1831 to 1849 inclusive. Out of twenty-nine pages called history, ten pages are taken up with valve gear, and the nineteen previous give fifteen woodcuts of consecutive engines, beginning with Murdoch and ending with Crampton. The structure and performances of most are remarked on; but we do not find more than one incidental notice of steam pressure, viz., 50 per inch in the Rocket.

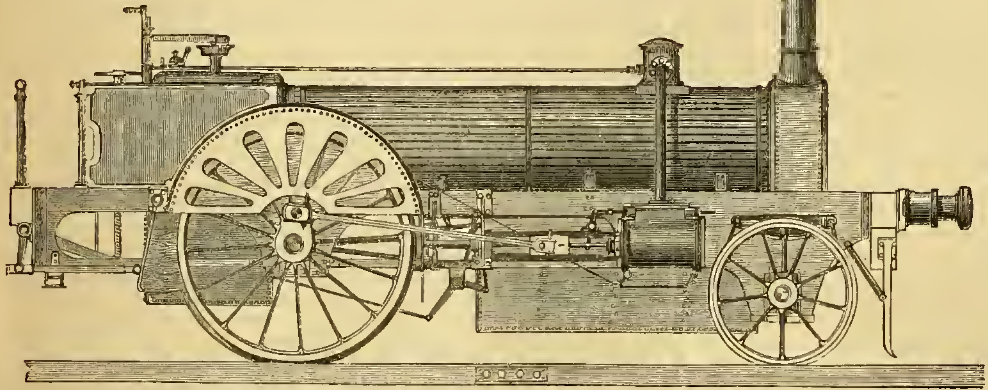
We are at a loss to understand why, from this "history," has been excluded the light locomotive of Mr. W. Bridges Adams, first appearing in 1847 as a diminutive model machine, with cylinders 3 inches in diameter and 6 inch stroke, and subsequently growing, in 1849, to the form of the woodcut now given.

Taking up Mr. Clark's work, we have diligently sought for some notice of this, and in Part XVI., page 185, we find a small outline diagram amongst twenty-one others, and the following brief notice—"No. 22 has the old fault of an overhanging fire-box, and is unfitted for running alone, and unsupported, with steadiness."

We cannot imagine how such a remark has slipped into the work. The first sample of this engine was built for the Enniskillen Railway, and a second for the St. Helens. They are notoriously of the steadiest class of engines, and economical in every way for the work they are applied to. A mere glance at the engine demonstrates that the centre of gravity is low, and the base extended, two conditions tending to defeat the evil of want of balance, even if such existed, while the small size of the fire-box, and the great length before the driving axle, render the term "overhanging" a mere phrase without meaning.

We do not understand why Mr. Clark has ignored this fact in the history of locomotives, omitting all mention of that which must be taken into account in future progress. As we think that Mr. Adams has done considerable service to locomotives, and know that the works which bear his name are but a small part compared with what he has written anonymously, and has, moreover, put into practice a considerable number of improvements, both in fixed and rolling stock, we will endeavour to point them out—commencing with his locomotive.

The four-wheeled engines of 1830 were very short and very high, and with nearly all the weight on their hinder wheels, constantly jumping on the rails, the pressure in the boiler being about 50 lbs. per inch. The disadvantages arising from a misplaced centre of gravity were so great, that extra wheels were placed behind the fire-box, and thus commenced six-wheeled engines, growing gradually to eight wheels, and increasing in weight, year by year, till rails and road were crushed beneath them, because people did not perceive that want of foothold, and not want of power, was the true cause of defective haulage. This Mr. Adams did perceive, and studied long and earnestly for the remedy.



Mr. W. Bridges Adams' Light Locomotive Engine.

The principles he worked on were—First, to proportion the power to the load, and to use light engines for light trains of passengers—thus diminishing proportionate dead weight to paying load.

Secondly—To lower the centre of gravity, and to extend the base, so as to make the engine steady as a carriage, and able to resist the mischievous action even of unbalanced machinery.

Thirdly—To make the engine a self-contained machine, independent of a tender for fuel and water.

Fourthly—To diminish the size of the fire-box, and the diameter of the boiler, so as to work with a less load of water, and to compensate for this saving by increased pressure—which, we believe, he was the first to practice—up to 120 lbs. per inch, with perfect safety, by reason of the greater comparative strength of his boiler, making, as it were, a blood-horse instead of a cart-horse, with better nerve and muscle. We know that the director of a northern line, witnessing the great performance of one of these engines, compared with its small bulk, remarked to his locomotive superintendent—"Why do not we use the same pressure on our engines?" The answer was—"We dare not with our boilers."

Fifthly—To proportion the diameter of the tubes to their length, obtaining all the practicable impinging of the heat without spoiling the draught; regarding the tubes as so many horizontal chimneys, and treating them accordingly.

Sixthly—To apply these light engines to the occasional traction of heavy trains, by coupling two together, so as to make them practically a four-cylinder engine, with double adhesion, and without the disadvantage of the ordinary coupled wheels, involving surplus friction.

Seventhly—To make the engine four-wheeled, in order to maintain adhesion, while keeping a light weight, in order not to damage the rails or roadway.

Seven engines were constructed previous to arriving at the design shown in our sketch; and we will now compare it with the diagram of a four-wheel engine of Mr. Stephenson, given by Mr. Clark, Plate VI., Part I., and the engine long used on the London and Birmingham, and known as the Bury Engine; also a four-wheel engine, given in a woodcut by Mr. Clark, p. 13, to show the essential points of difference.

Stephenson, Newcastle, 1830. Tender Engine, 4 Wheels.	Edward Bury, 1830. Tender Engine, 4 Wheels.	W. Bridges Adams, 1849. Enniskillen. Tank Engine, 4 Wheels
Drivers, 5 ft.	Drivers, 6 ft.	Drivers, 5 ft.
Leaders, 3 ft. 4 in.	Leaders, 4 ft.	Leaders, 3 ft.
Wheel centres apart, 5 ft.	Wheel cen. apart, 5 ft. 6 in.	Wheel cen. apart, 10 ft. 3 in.
Inside cylinders and crank axle.	Inside cylinders and crank axle.	Outside cylinders & straight axle.
Length of fire-box, 2 ft. 2 in.	Length of fire-box, 4 ft. 3 in.	Length of fire-box, 2 ft. 9 in.
Length of barrel, 7 ft. 3 in.	Length of barrel, 8 ft.	Length of barrel, 10 ft. 3 in.
Diameter of barrel, 3 ft.	Diameter of barrel, 4 ft.	Diameter of barrel, 2 ft. 6 in.
Height of boiler from rails, 6 ft. 9 in.	Height of boiler from rails, 8 ft.	Height of boiler from rails, 5 ft. 8 in.
		Len. of connect. rod, 5 ft. 3 in.

It therefore appears that Adams' self-contained or tank engine has a length of base of 123 inches, while the tender engine of Bury is 66 inches, and the tender engine of Stephenson 60 inches; and the height of Adams' boiler is 68 inches to Bury's 96 inches, and Stephenson's 81 inches; the relative pressures on the boilers being Adams' 120 to Bury's 50 to 80 lbs. on the square inch. And Adams' boiler, 123 inches long to 30 inches diameter, is comparatively the longest boiler that has been made, being over 4 diameters in length; Stephenson's longest being 168 inches to 42 inches—exactly 4 diameters.

We have taken some pains to make this comparison, which should have been made by Mr. Clark, and without which his work is an incomplete history of the different stages of progress.

It is well known that in the discussion, some years back, as to the merits of four and six wheel engines, Mr. Stephenson abandoned the four-wheel as of insufficient base, and Mr. Bury adhered to it, the practical fact being that Mr. Bury's was little better than a two-wheel engine, from its short base, and the absence of weight on the leading wheels. This was so obvious, that a writer in the *Railway Times* described it as being of the class of French poodle, which is popularly supposed to have its tail curled so tight, as to lift its hind-legs off the ground; and it was gravely proposed to use a kind of martingale traction, to prevent the front wheels from lifting by the snatches of the train.

From being so strong an advocate of the system of light engines, it has been sometimes supposed that Mr. Adams advocated their exclusive use; but we can find no such argument in his published works. He simply states, that there is a crushing power in excessive weights on the driving wheels of engines, which should not be suffered to exist, and that the weight on the wheels, to be economically borne, must be within the limits of destruction to the rails.

That Mr. Adams was right in his principles, is proved by the fact, that Messrs. Stephenson & Co., of Newcastle, have adopted the same class of four-wheel engines since 1851, reproducing in the tank form, and with better combination, that which they had abandoned since 1830, a lapse of twenty years. The engine is given by Mr. Clark, but without remark or criticism, other than a description, in Plate XXVIII. The following are the particulars:—

Tank Locomotive by Robert Stephenson & Co., Newcastle-on-Tyne.

Four Wheels.	FEET.		INCHES.
Drivers,	5	...	0
Leaders,	3	...	0
Wheel centres apart,	10	...	4
Outside cylinders and straight axle.			
Length of fire-box,	2	...	11¼
Length of barrel,	11	...	4
Diameter of barrel,	3	...	0
Height of boiler from rails,	6	...	2
Length of connecting-rod,	4	...	2

Taking into account that Mr. Adams' engine has cylinders 9 inches in diameter, (several have since been constructed by Mr. Adams with 10 to 11 inch cylinders,) and that this tank engine of Messrs. Stephenson has 11 inch cylinders, it is obvious that the proportions are as nearly alike as possible, and, considering the reputation of the firm of Messrs. Stephenson & Co., a strong testimony to their correctness. But there is one obvious advantage in favour of the construction of Mr. Adams, his connecting-rod is 5 feet 3 inches in length, whereas that of Messrs. Stephenson is only 4 feet 2 inches, which must make a considerable difference in friction. And, to quote Mr. Clark's words, " The shorter the connecting-rod the greater is the irregularity introduced into the strokes of the piston."

The proportion in Mr. Adams' engine is nearly 8½ times the length of the crank; in that of Messrs. Stephenson it is little over 5½. Mr. Clark considers, p. 193, that " the connecting-rod should be, *at least*, six times the length of the crank."

Mr. Clark strongly insists on the importance of accurate balance of the working machinery as a condition of steadiness; but we think, however well balanced, he would scarcely advocate the haystack form of Bury's engine, as well adapted to swift forward motion, even if the form of the boiler were well arranged.

Leaving the history of locomotives, Mr. Clark enters on the physiology of the locomotive—a good and expressive term. His first chapters set forth very clearly and distinctly the mechanical philosophy and the arrangement whereby, by means of the link motion, steam is, as it were, put into the trammels of a mechanical master, and is forced to do his bidding, making its entrances and exits when and where and how it is directed. The style of this dissertation, in its clearness and simplicity, reminds us much of the style of Mr. Farey's History of the Steam Engine. The mode in which the steam acts on the locomotive, and the processes for measuring its effects on the cylinders, by indicator diagrams, is next clearly treated, for those competent to understand it; though we have heard of a gentleman, professing to be a railway engineer, who, on being shown some diagrams, declined examining them, on the score of their being " book matter," and he was a practical man; as if sitting on the buffer beam of an engine at sixty miles per hour, to watch its automatic registration of its own performances, were a question of mathematics. We quote, for such gentlemen, the following very practical passage:—

" We have seen how much the mechanical efficacy of steam is opposed by atmospheric resistance, and impaired by clearance and back pressure. It is known, also, how severely steam suffers by condensation in the cylinder, under certain circumstances. These are all impediments to the complete success of expansive gear. Another, but less obvious impediment, is the adoption of a low standard of boiler pressure; because the lower the kind of pressure, the greater is the relative loss by the atmosphere; but principally because the expansive functions of the valve gear are less available. On level railways, like the Edinburgh and Glasgow, this objection exists with greater force than even on railways with steep gradients, like the Caledonian; because, on the former, the pull is nearly uniform throughout, and, therefore, a constant high pressure on the boiler would be the more necessary for carrying out great expansion; whereas, on the latter class of lines, a lower boiler pressure may suffice for purposes of expansion on descending gradients, where but little steam is required. Moreover, the evil of low pressure is, as we have proved in the last chapter, greatly aggravated by the resistance of the passages to the flow of steam from the boiler at high speeds, which reduces the available pressure in the cylinder, precisely at the time it is most wanted. It is clear that, in general practice, cutting off at half-stroke is inferred good work for expansion, and very rarely, indeed, is the admission reduced below 30 per cent. of the stroke. There is no sufficient reason why the ultimate expansion of steam, enforced in certain classes of stationary engines, should not be more thoroughly followed out in the practice of locomotives, seeing that, by the link motion, a minimum suppression of 10 to 20 per cent. of the stroke is available. We have clearly shown that, in exposed cylinders, the economical use of expansive gear is limited by the formidable condensation that attends great expansion. In all locomotive engines it is essential, to the entire success of expansive working, that the cylinders be well protected and well heated; that all the steam passages be wide and free; that the valve gear be maintained or put into order, so that early suppressions may be effected, because the wear of the valve gear delays the movements of the valve, and lengthens the admission, especially towards mid gear; that, by improved arrangements, the clearance at each end of the cylinder should be reduced to the lowest possible practice, and that a high pressure on the valve of 100 to 150 lbs. should be constantly maintained."

This is a very clear summary of the conditions essential to the economical and effective working of the engine portion of a locomotive, a canon of locomotive law, which should be got by heart by all empirical locomotive builders, to keep them straight in the main. Mr. Clark reiterates these laws at greater length by a recapitulation, ending, as a climax, with " high pressure in the boiler!" or, as a horse-jockey would say, " a good bread-basket."

He then goes on to the physiology of the boiler, giving, first, a clear analysis of the properties of fuel, and the experiments of various kinds for the generation of steam; then the question of heating surface, the blast, the smoke-box vacuum, the proportion of chimney diameter and height, the evaporation, condensation, and consumption of steam, the question of waste by priming, grate surface, and its proportion to heating, and the proportion of fuel to vaporised water. All these parts are discussed in detail with the skill of a master in the art; and if there be disputable points in matters subject to the influence of so many varying circumstances, the analysis still leaves clear to every comprehensive mind the field of experimental process.

Chapter VI. opens up the discussion of the causes of instability of engines due to the permanent way, form of rails, clearance of rails and maintenance of way—to which we shall revert hereafter—and with a very short notice, ending with the words, " a well-made way is quite as important as a well-balanced engine." Then commences a new chapter, on the causes of instability due to the wear and tear of the machine, arising from want of parallelism of the axles, unequal duration of the wheels in the same axles, and wear of the tyres. Then come a series of diagrams of the processes of wear in the engine tyres. This is a subject for deep thought, and indicates how very imperfect the engine still is regarded as a wheel carriage; how very much of sledge movement must be combined with the rolling movement, to produce the results of mischievous wear which Mr. Clark has so faithfully portrayed and diagramed.

A very instructive chapter follows on the conditions of general arrangement, and the disposition of the weight consistent with the stability of locomotives—though we cannot agree with all the dicta. In saying that " the leading wheels should be well forward, and the trailing wheels well backward," Mr. Clark states a truism, which is equivalent to saying that an extended base is an advantage to prevent unsteady action. But when he says, that " the proper function of the fore-wheels is to guide the engine laterally, and that of the hind-wheels to prevent pitching vertically, his criticism can only have reference to a six-wheel engine, ignoring a four-wheel altogether, and suppressing or omitting the real defects of the six-wheel. Everbody knows that to push a long mass is much more difficult than to pull it, and the former process involves much more unsteadiness. In proportion as the drawing power is astern, so much more steering will be wanted, just as a vessel with the paddle-wheel far aft will yaw under the opposing influences of the water, and require more helm power to keep her straight than when the paddle-wheels are well forward. And even four-wheeled engines will run best with the driving-wheel foremost, and the length of the machine trailing. Mr. Clark has given two sheets of diagrams, illustrative of the outline forms of engines—one sheet with inside cylinders and crank axles, the other with outside cylinders and straight axles. Of the inside cylinders, the two first are Stephenson and Bury's four-wheel, the shortest ever constructed. No. 10 is a four-wheel by Mr. Adams, with 10 feet 6 inch centres of wheels, and No. 12 is a six-wheel by Fairbairn, with 11 feet 8 inch centres; and of these Mr. Clark says, " They are stable machines, with moderate wheel bases of from 10 to 12 feet, suitable for light engines, and qualifying them to pass along curves, and run either end foremost with facility and safety."

Here there are two light engines, one with six, the other with four wheels. The weights on the four wheels must, it is evident, always be constant, or varying only with the consumption of fuel and water, and this whether the rails be a horizontal level or a horizontal curve. The weights on the six wheels must, on the contrary, be inconstant on an uneven line, for if the drivers be on a bad joint, the weight will be supported on the leaders and trailers; or, if to prevent this, the driving wheels bear a greater load, the engine will, on any other part of the road, have a tendency to pitch fore and aft. Now, this six-wheel engine has 7½ tons on the central drawing wheels, 3¾ on the leaders, and 3¼ on the trailers. This is a condition of pitching, and if the weight be reduced on the drivers, and increased on the fore and aft by alteration of the springs, then comes the condition of " slipping." From this inconstant condition, the four-wheel locomotive with extended base is free. The weight is nearly equal on drivers and trailers, and the pressure will be alike, whatever be the condition of the rails. In both these engines the crank-shaft, with a load on it, is a serious objection; and we cannot agree with those who doubt the value of a separate crank-shaft, to relieve it from weight where inside cylinders are essential. For example, on the 7-feet guage, the width renders outside cylinders objectionable, and a crank axle is still more objectionable with much load on it, as involving a large mass of material. In an engine constructed by Mr. Adams for the broad guage line, he adopted this principle. The engine was, practically, a two-wheel engine, forming part of a six-wheel steam carriage for the rail, and lightness was desirable. The driving-wheels were the leaders, and the four carriage-wheels trailers. A cranked axle for a 7-feet guage, carrying the whole load of the engine, was out of the question, and, therefore, inside cylinders were used with a separate crank, and the motion was carried to the driving-wheels by connecting-rods. Ultimately it was found inconvenient to have the engine a part of the carriage, and they were separated, and a pair of trailing-wheels applied. A description of this engine—the Fair Field—will be found in 'Road Progress,' which, while working as a steam carriage, could take 32 tonss additional train load up gradients of 1 in 86, the cylinders being 8 inche diameter, 12 inch stroke, and the driving-wheels 4 feet 6 inches in diameter.

It was subsequent to this that the modification of Crampton's engine was introduced, as stated by Mr. Clark, for the South-Eastern line, with a separate crank shaft and inside cylinders. But this arrangement destroyed the material advantages claimed by Crampton for his engine. The throw of the crank and eccentrics restored the boiler to its previously elevated position, raising it nearly a foot in height, and reducing the driving diameter from 8 feet to 6 feet, while keeping the extreme length at 16 feet, the whole propelled from behind—a serious disadvantage on curves.

Two examples are given of engines with coupled wheels by Mr. Sinclair of Glasgow. No. 35 is a six-coupled—the most objectionable of all coupling. In No. 36, the middle wheels are suppressed, and a crank shaft substituted for them. Were the connecting-rod longer, we should consider this as one of the most efficient engines we have seen for drawing a heavy load. But there is a serious objection to all coupled wheels. There are three important conditions of accuracy: First, That the coupling rods should be exactly alike. Secondly, That all four wheels should be of exactly equal diameter; and thirdly, that the rails should be exactly true and parallel, giving a bearing to the wheels at the same diameter of cones. We doubt if this can be accomplished in our present condition of knowledge and workmanship, but, undoubtedly, Mr. Sinclair has the merit of producing, so far, the best construction of coupled wheel engines.

The worst construction of coupled engine we have seen, is No. 37, by Stubbs of Lincoln. It has four pair of coupled wheels, 3 feet in diameter, and the cylinder pitches at an angle of about 30 degrees with the horizon, while the connecting-rod is little over 4 feet in length, and with these extremely low wheels, the engine is still 7 feet in height above the rails. As the worst position for the cylinder of a locomotive engine is to be vertical, it follows that the best is to be horizontal, for in that mode the springs can act most efficiently, without interfering with the action of the pistons; and, as before stated, a long connecting-rod is essential. If, for example, a two feet connecting-rod were used with a four feet stroke, at one period its thrusting action would be at an angle of 45 degrees with the slide bars, an enormous loss of power, besides other disadvantages.

In the arrangement of bearing springs, Mr. Clark approves of compensating levers, or equilibrium springs, as in the bogie frame of the Great Western, fig. 226; the spring spanning from axle to axle, a length of 5 feet, and the weight of the engine resting at the centre. The hind wheels are equilibrated in a similar mode, with a beam nearly 8 feet in length, from which the spring is suspended. But it is quite evident that this principle diminishes the length of the engine base on the springs, and defeats, to a certain extent, the advantage Mr. Clark insists on of extending the spring base laterally. With a spring to the axle-box of each wheel, the base is as extended as the wheel centres and bearings, and we do not think that the balance of advantages is in favour of this Great Western system. For example, the equilibrated base of this engine is under 12 feet longitudinally, and the weight of the bogie frame is made to bear directly on the axles, though the weight of the spring is relieved from them by hanging on its taper ends, and the bogie frame being far heavier than the springs, the evil of weight is increased. And the equilibrating beams behind are so much increased dead weight, without in any way relieving the load of springs. Had this engine been springed in the usual way, the longitudinal base on the springs would have been 18 feet instead of 12, which it now is, while the total length of the boiler and fire-box is also 18 feet, 3 feet overhanging at each end.

In truth, most engines on railways are still a mass of contradictions, badly wheeled, badly sprung, badly balanced, and with an inconvenient centre of gravity, which becomes, under very slight exciting causes, a centre of oscillation. They are yet very far from what they ought to be. A better means of increasing adhesion for large loads, without increasing friction, has yet to be discovered. A simplification of parts is still desirable, and if the centre of gravity could be made a pendulum, instead of a prop, we might hope for such a mode of springing as would give an equal floating balance to the whole machine. We are far from that yet.

Mr. Hawthorn's mode of equilibrating: the length of the boiler and fire-box is 19 feet, pushed forward over the wheels, whose extreme centres are 17 feet, while the spring bearings are 9 feet, the whole weight of the springs and balance beams being dead on the axles. Mr. Clark notices this in Hawthorn's engine, but not in Gooch's.

Mr. Clark appears to regard a high centre of gravity with indifference, because, with a well-balanced engine on a good road, he has run steadily. But this is merely tempting Providence, as the old men of Stage Coaches did, and without their economical reason. "Safety coaches" well balanced, and with a low centre, of gravity, they did not like; they found a certain advantage to their horses in a high-pitched load. An oscillating centre of gravity enabled the wheels easily to hop over stones and obstacles, and risk to passengers was considered a small evil in comparison with the advantages of saving horse flesh.

Mr. Clark objects to transverse springs alone, and prefers Mr. Crampton's system of bearing on three points two longitudinal, and one transverse spring. We think, however, that a high-pitched engine thus springed would be a dangerous machine, and that Mr. Crampton has only been enabled to accomplish it by virtue of a low centre of gravity. The three points of bearing is the common arrangement of modern highway carriages, long known. Could the centre of gravity be kept at the level of the axles, or below them, there is little doubt that the machine might be advantageously hung on transverse springs, as were the stage coaches, leaving the wheels to move freely on inequalities, without much disturbance to the body.

The real difficulty in lowering the centre of gravity in engines, exists in the fire-box, which must have a sufficient depth of from 18 inches to 2 feet, in order to keep a depth of fuel below the level of the tubes; this difficulty surmounted, all else would be comparatively easy.

The Calculator's Constant Companion. By Oliver Byrne. Philadelphia: J. W. Moore. 1854.

The author of this "companion" says, very truly, that economy in mental labour is as desirable as in physical exertion, and that the discovery of logarithms has done as much in economising mental labour, as the introduction of steam has accomplished in mitigating the severities felt by all who labour to the sweat of their brow. The author is also correct in stating, that the tables composing his little book, and which are the result of 100,000 calculations, are only second to tables of logarithms as a means of saving mental labour. The tables in question contain calculations upon the numbers 1 to 10,000, these calculations consisting respectively of 1, 2, 3, 4, 5, 6, 7, 8, and 9-10ths of each number. The uses of these tables are numberless; but the calculator will find it especially adapted in operating with logarithms, for determining numbers lying between those given in logarithmic tables. An example in simple multiplication will show the manner of using the tables. Suppose we have to multiply a long line of figures by 356; we turn to the number 3560 in the tables, and then reading off the number corresponding to each figure in the multiplicand in succession, write it down in due order, and sum up as in ordinary multiplication. In this way the usual mental process of multiplying the multiplyer by each figure is saved. We can speak from experience as to the usefulness of these tables, for we have ourselves frequently found it a saving of time, not only to use this kind of a table, but actually to construct the portion of it we required for any particular set of calculations.

There is only one point upon which we disagree with the author. His calculations are decimal parts of the number or argument; now, we think they would be better were they multiples, and that there would, in that case, be less risk of error in assigning them their relative positions in any calculation.

The book is neatly printed, and is of convenient size.

A Manual for Practical Surveyors. By E. W. Beans. Philadelphia: J. W. Moore. 1854.

The Practical Surveyor's Guide. By Andrew Duncan. London: Sampson Low, Son, & Co.

These hand-books are both by American surveyors, and both authors profess to offer a work especially adapted for assisting those engaged in practical operations in the field. Mr. Beans' work evinces the closest accordance with these professions, and contains clear explanations of the great variety of expedients for obtaining measurements, which the practical surveyor must adopt in the many cases which occur where direct sights cannot be taken. Still the book is only suitable for beginners, and may be carried about by young hands as a means of refreshing the memory on points not sufficiently impressed thereon by actual practice.

Of Mr. Duncan's book, about a fourth part is all that may be said to come at all near the alleged characteristics of the work, and even this contains nothing relating to field expedients, which is what is wanted by the beginner in practical surveying. Indeed, we have seen many treatises on arithmetic which contain as much as can be learnt from this fourth part of Mr. Duncan's book. The remaining portion is introduced by the author's saying—"It was not his intention to say anything concerning this branch of surveying (trigonometrical surveying), as it is too extensive a subject for this small work; but, as some young readers may not have met with anything on that subject, I will present them with an outline of how that grand operation is conducted;" and so our author extends his "present" (?) over three-fourths of the book, although, at starting, he did not intend anything of the kind. This looks very much as if the "practical" matter was found not to make a sufficiently large book, and the "present" was added as a make-weight.

Both books are wanting in indexes or lists of contents—a serious defect in works of this kind, which are essentially intended for constant reference.

British Workman, and Friend of the Sons of Toil. Parts IV. and V. London: Partridge, Oakey, & Co. 1855.

The unabated good quality of this little pictorial monthly, which well sustains its right to the good opinion expressed by us as to its earlier issues, has not hitherto met, we regret to say, with corresponding reward. At a circulation less than 20,000, it is issued at a heavy loss. The matter of the last two numbers is characterised by the same good points as their predecessors, and the illustrations carry evidence of the same bold and free handling. One engraving, illustrative of "The Old Coach Horse," is a fair copy of a "Bewick" tail-piece. It deserves to succeed.

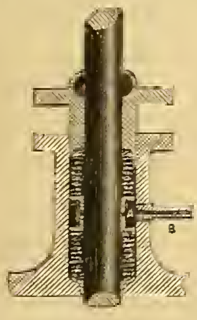
CORRESPONDENCE.

DOUBLE-ACTING PUMPS, AND PUMP STUFFING-BOXES.

Seeing, in the June Part of the *Practical Mechanic's Journal*, the report of a paper read before the Royal Scottish Society of Arts, April 23, by Robert Aytoun, Esq., on Double-acting Pumps, I write to state that we have had at work here, for some time, supplying the city with water, a pump on the principle explained in that paper, the size of working barrel being 11½ in. diameter, plunger 8 in. diameter.

Many persons have claimed the invention of this arrangement, thinking it was previously unknown. I have, however, been informed that the original invention is due to Smeaton, but cannot say whether or not it was ever practically applied by him.

I have heard general complaints of the failure of the double-acting pump, on account of the air being drawn down the stuffing-box. I have, however, found this easily guarded against, by adopting the plan invariably used in the Cornish pumping engines for preventing the air from getting into the cylinder through the stuffing-box of the piston-rod. The following sketch will easily illustrate this contrivance.



A species of lantern brass, A, is inserted in the centre of the packing, and the body of this brass is perforated to admit water from the small pipe, B, to the rod. In the steam engine, this pipe, B, is connected to the steam pipe, but in the pump it may be connected to the discharge pipe, which being always full of water, water will enter in through the brass, A, and effectually prevent the ingress of air to the pump barrel—the water being drawn in instead of air, when there is any tendency to draw anything. The brass should have two slots in its top flange, to admit handles for lifting it out by, when it is necessary to renew the packing below the brass.

Lincoln Water Works, July, 1855. H. Teague.

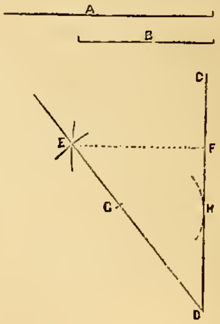
DOUBLE-ACTION FORCE-PUMP.

I perceive, in the *Practical Mechanic's Journal*, that a Mr. Aytoun has exhibited a model of a double-action force-pump at the Royal Scottish Society of Arts. Now I invented the arrangement described by Mr. Aytoun, so long ago as eight or ten years. My pump is still at work, and may be seen any day, at the Ynisygeinon Colliery, the property of Thomas Watters, Esq., of Swansea. My arrangement will work from a two-inch pipe up to any size.

Ynisygeinon Colliery, July, 1855. Rees Thomas.

COPYING DRAWINGS TO A REDUCED SCALE.

Some time ago, I had occasion to reduce a number of small drawings, and not having a pair of proportional compasses at hand, I devised a plan which was new to me, and which appears to be as speedy in its application as proportional compasses, and at the same time as correct. The new application of an old mathematical principle may be useful to some of your readers, if thought worthy of a place in your useful journal.



Let the line, A, represent the size or scale of the original drawing, and B that to which the copy is to be reduced. Then on waste paper draw a line, C, D, and from D, as a centre, with a distance equal to A, draw an arc as at E; cut this arc by a line parallel to C, D, so that E, F, a perpendicular to C, D, may be equal to B. Draw a line from D through E, which completes the diagram. To use it, a distance is taken, with compasses, from the original drawing, and is applied from the point, D, along D, E, say to G; the point of the compasses at G is kept stationary, and the other point is shifted so as to find the perpendicular distance, G, H, between the point, G, and the line, C, D, which distance is then transferred to the reduced copy, and so on with every size which requires to be measured. The mathematical student will not require a demonstration of the correctness of this plan, as it is obvious. The time required in using it, is little more than for taking measurements to a drawing of equal size, as the altering of the compasses is the work of an instant.

Edinburgh, July, 1855. G. H. S.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF MECHANICAL ENGINEERS.

April 25, 1855.

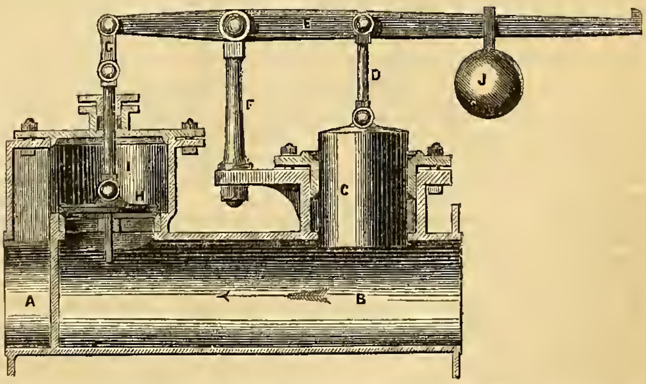
"On a new Moulding Machine for Cog and other Wheels," by Mr. P. R. Jackson, Manchester. This is the ingenious contrivance which has been some time at work in Mr. Jackson's establishment, moulding wheels by means of a traversing segment of the pattern.

"On an Improved Tuyere for Smiths' Hearths," by Mr. John Fernie, Derby.

"On the Commercial Economy of Working Steam Expansively in Marine Engines, with Description of a New Double Expansive Marine Engine," by Mr. E. E. Allen, London.

MONHTLY NOTES.

Baxter's Steam-pressure Regulator.—We have already illustrated one modification of Mr. Baxter's Regulating Valve,* and the one we now engrave is a more recently devised arrangement. In this regulator, the long chamber, A B, forms part of the line of steam pipe, the steam pressure from which is to be reduced and regulated. The high pressure steam is allowed to flow in the direction of the arrow through the end or branch, B, of the apparatus; when so admitted, the steam acts upon the bottom of the piston plunger, C, working through a stuffing-box in the upper side of the pipe, and having its upper projecting end connected by a link, D, to the longer arm of a lever, E, set on a stud centre, F. The opposite shorter arm of this lever is linked at G to the spindle of a lift valve, H, of the same effective steam area as the piston. This valve is contained in the separate chamber or division, I, and its spindle works through a stuffing-box on



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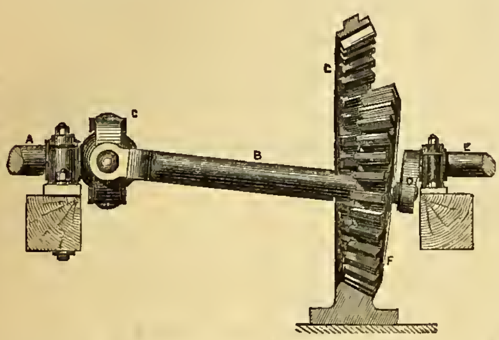
* Page 67, Vol. VI., *Practical Mechanic's Journal.*

the top of this chamber. An adjustable weight, J, is hung to the longer arm of the lever, as in the former example already referred to, and the effect of both plans is precisely similar. The preponderating weight, J, partially opens the valve, H, and the reduced steam then passes off by the branch, A. Variations in the pressure of the steam in the branch, B, will not affect the pressure in the branch, A, as the valve, H, will close or open to an extent corresponding to the change in the pressure of the entering steam when any change occurs.

MULTIPLYING GEAR FOR SCREW PROPELLERS.—Mr. Washington Jones, a member of the Franklin Institute of the United States, has recently devised the very ingenious multiplying gear represented in our engraving. In this arrangement, the engine shaft, A, is connected to a short shaft, B, by means of a ball and socket joint, C, allowing the latter shaft to be slightly inclined to the engine shaft, A. The other end of the shaft, B, is entered into bearings in the end of a crank, D, which is formed upon the shaft, E, carrying the propeller; this shaft being in a line with the engine shaft, A. The shaft, B, has keyed upon it a bevil pinion, F, which is kept in gear by the crank, D, with an internally-toothed stationary bevil wheel, G, fixed to the framing of the ship, and represented in section in the figure. On the shaft, A, being turned, it causes the shaft, E, to revolve in the contrary direction, with a relative speed depending on the proportions the wheels F and G have to one another. Supposing there are 30 teeth in the pinion, F, and 35 in the wheel, G, the speed of the shaft, E, will be six times that of the shaft, A. The speed of the driving shaft is to that of the driven shaft, as the difference in the number of teeth in the pinion and wheel is to the number of teeth in the former. The same proportions of teeth, namely, 30 and 35, would produce a speed seven times the speed of the shaft, A, if the wheel, G, were fixed to the shaft, B, and the pinion, E, to the side of the ship, for then the speed of the shaft, A, would be to that of the shaft, E, as the difference in the number of teeth in the pinion and wheel is to the number of teeth in the latter, and the motion of the shaft, E, would be in the same direction as that of the shaft, A.



MARINE MEMORANDA.—On the 3d July last, a new steamer, the *Persia*, for the Cunard line, was launched on the Clyde, near Glasgow. The *Persia* is the largest paddle steamer afloat; she is 40 tons larger than the *Himalaya*, and nearly as large as the *Duke of Wellington* and *Royal Albert*. Her principal dimensions are—390 feet over all; 45 feet breadth of hull: 71 feet breadth over all; depth of hold 32 feet; burthen, 3590 tons. The *Persia* is built by Messrs. Robert Napier & Sons, who are also fitting her with engines, which are to be 850 horse power. The *Persia* was originally intended to be propelled by the screw, but the Government, at the time, disapproved of this plan, although latterly they would have permitted it, the recent successes of screw-propelled vessels having demonstrated its suitableness. The *Persia* is probably the last steamer the Cunard Company will build to be propelled by paddles. The launching of the *Persia* was a more than usually interesting event, both on account of the immense size of the vessel, and on account of the peculiarities of the locality. The Clyde at Govan, where the launch took place, is scarcely wider than the length of the vessel, but the vessel's keel was laid as nearly parallel with the river as possible, and a slight bend in the river also helped to give more room. There was, however, no room whatever to spare, and great praise is due to the managers of the launch for the excellent manner in which it was effected. The vessel paused an instant after the daggers were struck away, but she gradually got into motion, and glided down the ways slowly and gracefully. She was stopped within a very short distance by means of enormously strong chain cables passed from her hause holes to a pair of anchors built into the ground: but she drew these a considerable distance before she came to a stand-still. The inclination of the building-slip was, as it turned out, very accurately calculated; for a little less inclination would probably have prevented her moving at all, whilst a little more would have given her an impetus which would have carried her to the other side of the river, notwithstanding all precautionary measures.

The speed of the Queen's new yacht was tried against that of the *Fairy*, the other day, in a run from Cowes to the Knab light vessel, a distance of twelve miles. Her Majesty and Prince Albert and the King of the Belgians were on board the *Fairy*, and witnessed the trial. The latter started from Cowes with the royal standards flying from her mainmast head, and, having got some considerable way ahead, signalled the *Victoria and Albert* to follow in chase, when she was swiftly overtaken and left astern, the *Victoria and Albert* dipping her ensign in passing, and, on reaching the Knab, the *Fairy* was left nearly two miles astern. The "recall" was then made, and, before reaching Osborne on the return, the larger yacht was again considerably ahead.

Not many days ago, there were in Southampton Docks nearly 54,000 tons of steam shipping, the principal portion of which consisted of vessels belonging to the port, which are and have been employed by Government in the conveyance of horses and troops to the East, viz.:—Her Majesty's screw steamship *Himalaya*, 3,438 tons; Royal Mail Company—*Magdalena*, paddle, 2,944; *Orinoco*, paddle, 2,901; *Dee*, paddle, 1,874; *Derwent*, paddle, 794; *Solent*, paddle, 1,805; *Tamar*, paddle, 1,964. Peninsular and Oriental Company—*Colombo*, screw, 1,864; *Euxine*, paddle, 1,165; *Tagus*, paddle, 782; *Madrid*, paddle, 479. Australian Royal Mail Company—*Victoria*, screw, 1,878; *Adelaide*, screw, 1,860; *Australian*, screw, 1,392; *Sydney*, 1,392; General Screw Company's steamship *Jason*, 2,668; United States Company's steamship *Washington*, paddle, 2,000; the screw steamship *Union*, 524; the paddle-wheel steamships *Queen*, 460, and *Noord*, 240; and the South-Western Company's paddle steamers *Courier*, *Transit*, *Atalanta*, *Wonder*, and *South-Western*, of about 300 tons burthen each.

Messrs. Wingate of Whiteinch, Glasgow, have just launched a fine example of an iron steam dredger, designed by Mr. Ure for the trustees of the River Clyde. The dredging buckets are to work in wells at the sides of the vessel, the receiving punts being loaded alongside, instead of at the end, as hitherto contrived. This obviates all loss of time from delay in changing the punts. The length of the dredger's hull is 120 feet; breadth of beam, 33 feet; and depth of hold, 10 feet. She is to be fitted with a forty-horse engine, and will be capable of dredging in 24 feet of water. When started, which will be in a very few weeks, it is expected that the new machine will be able to dredge continuously at all states of the tide.

THE FIRE-ARM AND AMMUNITION MANUFACTURE.—We have for some time watched with interest the widely-spread progress of the manufacture of arms. Birmingham, once the great centre of this peculiar trade, seems to be parting with a large proportion of its work in favour of the Lancashire machinists, who, having adapted automatic machinery to so many labour-saving purposes, now seek to be endeavouring to carry out their views in connection with the weapons of war. Mr. Preston of Manchester, the spindle and fly maker, who, as we have already said, has undertaken to apply his mechanical resources to the manufacture of bayonets and ramrods, has earned a large extension of his original contract by his rapidity of production. The backwardness of the Birmingham gunsmiths, in the substitution of mechanical aids for their old manual processes, must have read them a severe lesson, for we hear on all sides of the breaking out of the manufacture in new localities. Messrs. Sharp & Stewart, the locomotive builders, are engaged with mortars. Messrs. Platt have arranged machinery for the special manufacture of Lancaster shells, and they are now at work casting missiles of various kinds. Messrs. Hick of Bolton are also similarly engaged. The Shrapnel shell is likewise being made to a large extent by Messrs. Higgins of Salford. Government itself has actually taken up the idea of the machine manufacture of arms, and the works at Enfield are being prepared for the production of 100,000 rifles per annum. To show that they are in earnest, they have intrusted the making of the engines and gearing to Messrs. Fairbairn.

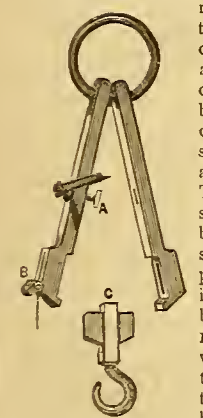
FIRE-ARM EXPERIMENTS.—The Government, under the pressure of public opinion, are at length taking measures to improve the weapons which are put into the hands of our soldiers for the purpose of fighting our battles. We allude to the series of important experiments conducting at Manchester by Mr. Whitworth, the eminent machinist, so favourably known to us all by his report on American art and machinery. A shooting gallery, 500 yards long, has been erected, and every contrivance has been adopted for making experiments therein under similar conditions. Protection from currents of air and uniformity of temperature are secured, and contrivances with reference to the recoil are adopted, the latter consisting of a framework resting upon a perfect plane. The gun is made to fit accurately into the framework, so that the recoil must take place in a line exactly parallel to the axis of the gun, and its amount can be calculated. When it is wished to prevent recoil, this can be readily done. The target is of iron, and is made to run on rails along the gallery; the distances being marked on the side walls, the exact number of feet it may happen to be from the piece is at once known. By interposing a series of paper screens between the piece and the target, the course of the ball can be accurately traced.

The Minie rifle, as used in our army, has a bore the 0·578th of an inch in diameter. Mr. Whitworth took this as his standard, and then made a series of "difference guages," as he terms them, bores gradually increasing or decreasing, at the rate of the 5000th part of an inch. Hitherto the Birmingham makers have not obtained a minuter standard of measure than the 350th part of an inch. Great inequalities have been found even in the most carefully finished barrels, impairing, of course, the precision of the fire, as was shown by the uncertain course of the ball on trial. Mr. Whitworth is said to have made two barrels, ten and twenty inches long, which are infinitely superior in this respect to anything previously constructed, though they have not reached the perfection at which he aimed. He has taken out several patents relative to fire-arms and artillery. One patent is for a rifled cannon, made of three cast or wrought-iron sections, capable of being securely fastened together by iron bands or rings, and taken to pieces when desirable. The interior is a nine-sided cavity, having the pitch required to make the ball rotate on being fired. Guns can be made, it is stated, on this plan, combining great strength with light weight. Another of his patents relates to a breech-loaded small arm, for which is claimed a decided superiority over every other invention. It is described as having a double chamber, on a line with the bore of the rifle, and having a reciprocating motion from right to left, or *vice versâ*, as determined by the soldier's hand.

It is high time that our immense resources in mechanism, and the inventive genius of the country, should be brought to bear upon the weapons we place in the hands of our soldiers. The system of mere routine and precedent will not do either in government or in manufactures, and the time is come when an alteration must take place. The Birmingham manufacturers of fire-arms have shown scarcely any disposition to adopt improved mechanism, or to aim at the production of a really superior article. The consequence is now telling upon them, for the Manchester machinists are now actively engaged in showing the nation, that what others refuse to do, they will; and we trust that we may be able to report in a short time that our munitions of war have been improved, in such a way as to make them worthy of this inventive nation and our gallant defenders. "As far as the manufacture of ordnance on the present system goes (says the *Times*), the Russians are fully our equals; and though it may be all very chivalrous to fight them with similar weapons, this mechanical nation has surely a right to expect, that on such a point the British army should have a decisive superiority over that of any other country."

A new artillery vent has just been tried at Woolwich upon an iron six-pounder. The arrangement consists of two pieces of brass, made to fit a groove bored in the vent field, the vent passage being through these two pieces. After the insertion of the pieces of brass, they were screwed down, and on the top of them, in a line with the surface of the gun, a nut was placed to hold them tight. If an enemy spiked the gun in an ordinary manner, by removing the nut on the top by means of a wrench, the vent was unscrewed, and the spike taken out. After each round was fired, the vent pieces were taken out and examined, and then replaced; after each round, the vent sank deeper into the gun. Ten rounds were fired, and after the tenth one a spike was driven in, which burst the nut, and the pieces of the vent remained in the gun. Every time the vent was taken out previously, it was found to be twisted.

Disengaging Life-Boat Hook.—Mr. Henry Redsull of Deal has recently registered the life-boat hook represented in the annexed engraving, the chief feature of the arrangement being a contrivance for facilitating the release of the boat when required. Upon a ring connected to the davit or other fixture from which the boat is suspended, are fitted a pair of clipping pieces, which are capable of separating or angling away from each other. In ordinary circumstances, these clipping pieces are held together by a T-headed swivelling bit, A, the head of which passes through a slot in one of the clipping pieces when these are brought together. The swivelling bit, A, is formed with a tail, which is entered into a jointed catch socket, B, and is held therein by a pin. The hook block, C, is held between the clipping pieces in sockets formed in their lower extremities, and these sockets being bevilled on their bottom faces, so that any downward strain on the hook has a tendency to separate the clipping pieces and release the hook. It follows, therefore, that when it is necessary to release the hook with the weight of the boat upon it, this can be effected by taking out the pin at B, and then turning the swivelling bit, A, a quarter round, which setting the clipper pieces free to separate, will allow the hook to fall away. Mr. Redsull wishes it to be known, that he throws open this invention to the trade for the benefit of the mariner.



Anniversary Dinner of the Society of Arts.—The one hundred and first anniversary of this society was celebrated by a dinner at the Crystal Palace, Sydenham, on the 3rd of July. The Duke of Argyll presided, and about 350 gentlemen connected with the arts and sciences of the empire attended. The noble chairman's speech referred, appropriately enough, to the vast progress of the arts and sciences since the formation of the society; to the encouragement which ought to be extended in this country to the cultivation of abstract science; and to the important subject of the education of the people.—Mr. Crossley, M.P., mentioned that, prior to 1851, his house had unsuccessfully competed with America in carpets; and that it was by means of the Great Exhibition they discovered that the excellence of American carpets arose from their being manufactured by machinery. Having expended a large sum in procuring machinery, they could now manufacture carpets for 2½d. a yard which formerly cost in labour 14d., the workmen now earning better wages and working fewer hours.—Professor Owen dwelt on the inadequate rewards and anomalous position of the men who devoted their lives to scientific pursuits in this country. In reference to the social position, national relations, recognition, and rewards of scientific merit amongst us, he made the following remarks:—"What these were of old—how they were once viewed—we see in the provisions made in mediæval times for the due dignity and independence of such master-minds as might achieve the higher posts at our Universities, such positions, for example, as the Deanery of Christchurch, Oxford, the Mastership of Trinity College, Cambridge, which the wisdom of our ancestors established for those men who won renown in the sciences, which alone were recognised in the time of the foundation of those and the like independent and dignified offices. The human intellect has since extended its conquests over a wider range and different fields; more congenial, perhaps, to its true aims and powers than the scholastical, logical, and theological studies which represented science before Galileo and Bacon. Has England continued to cherish and foster, in the same spirit, the new and fruitful natural sciences, as she honoured herself and manifested her wisdom by doing, in relation to the older forms of human knowledge? What, for instance, at the present period of her unexampled wealth—due mainly to the application of the abstract discoveries of science—what is the national relation of her Faraday? What is my own? Are we labouring, lecturing in national institutions, in fixed positions, absolutely exempt from the annoyance of individual interference or caprice, in the peace-giving certitude of the continuance of hardly-earned emoluments, with the cheering conviction of a suitable retiring provision when the wearied brain begins to fail in its wonted and expected efforts? As working men in our line, with bread to earn by the work we do, England owns us not; she ignores us in the sense in which she recognised and provided for her mediæval teachers. We are merely the servants of particular chartered bodies. As a comparative anatomist, indeed, I deem myself fortunate among my fellow-workers in the place I hold, but it needs only that a majority of the Council of the College of Surgeons should so will and vote it, and after nigh thirty years' service I must begin the world afresh. My masters are irresponsible, or only remotely responsible to public opinion. Hitherto England has devised no other or better position for the man whom she may delight to honour by calling "her Cuvier," than the curatorship of a museum belonging to one section of the medical profession. In my own case, indeed, the Council of the Surgeons' College have done me the honour to re-elect me annually, for some years past, to a professorship not previously held by the curator of their museum. But this position has none of that fixedness and independence which my brother professors of the same science on the Continent enjoy. When the First Consul of France revised the appointments and position of the professors in the national establishment of the Garden of Plants at Paris, the salary which he attached to the chair of comparative anatomy, with which the secretaryship of the sciences was then associated—the appointment, I say, was on such a scale, that the finance minister remonstrated. "Cuvier," replied Napoleon, "has a position in science; it is for the honour of France that he should be able to maintain that position towards the foreign *savans* who may visit Paris." Great is the pleasure with which I can state, that the short-comings of our national arrangements for analogous cases have been well understood by the most illustrious personages and individuals of the State, who have generously endeavoured to remedy and compensate for them. The noble lord at the head of foreign affairs, in the most handsome terms, gave my son a clerkship in his office. Sir Robert Peel, in assigning to me, a short time before his lamented death, a pension of £200 a year, well appreciated the acceptability of such a provision in the exemption from anxiety flowing therefrom. I shall never cease to gratefully cherish the memory of the wise and benevolent statesman, who created for me the satisfaction of feeling that, whatever might possibly cause a termination of my present appointments, I do not thereby fall into utter destitution."—Sir Joseph Paxton having heard that the Government was about to expend money on a large temporary building as a General Trade Museum, offered, on the part of the Crystal Palace Company, all the room in that edifice that would be required for the purpose. If the collection were deposited there, where it could be seen by millions, he undertook that it should be housed free of charge to the country. With regard to the rumour that Government intended this year to withdraw their annual grant of £1,000 to the Royal Society, which sum had been always expended in promoting scientific investigation, he reminded the ministers present that the Government derived £70,000 a year from inventors wishing to make their inventions public, and he thought that this money might be very properly applied through the scientific societies in furthering the interests of science. Complaints having been made of the great difficulty the speakers had in making themselves heard in that part of the Palace where the meeting took place, he promised that the defective acoustic arrangements should be remedied by another year.

The Ironstone Trade.—The increasing scarcity of ironstone in Scotland has created a good deal of uneasiness in the iron trade. Large quantities of the raw material are now being carried long distances to the furnaces to make up for deficiencies nearer at home. The Caledonian line now brings supplies from the north of England. There the discoveries in Cleveland have had considerable effect, and fifty smelting furnaces are in operation, or in course of construction, on the banks of the Tees. Apart from the large consumption of iron ore by those furnaces, some thousands of tons are sent weekly, by the Stockton and Darlington Railway, to the large ironworks on the banks of the Derwent, and by sea to those on the Tyne.

Society of Arts' Microscopes.—The silver medals of this Society offered for a school microscope, to be sold to the public at a price not exceeding 10s. 6d., and for a teacher's or student's microscope, to be sold to the public at a price not exceeding £3. 3s., have been awarded to Messrs. Field & Co. of Birmingham, by a committee of the Society, consisting of some of the leading microscopists of the day. The important position held by the miscroscope in relation to the sciences, and its great value in assisting to form those habits of observation which sound education endeavours to impart, induced the Council of the Society to offer these prizes, with the view of obtaining, for the public, good instruments at low prices. The Society has undertaken to purchase one hundred of the half-guinea instruments, and fifty of the three-guinea instruments. Members can obtain them, through the Society, at a discount of ten per cent. We understand that the Messrs. Field are about to erect special machinery for the construction of these instruments, in the expectation of a large sale, in which we hope they will not be disappointed.

Stereoscopic Daguerreotype.—A gentleman of Philadelphia, named Mascher, has made a communication to the public prints on this subject. When two pictures, taken with two ordinary cameras placed 2½ inches apart, are placed in the stereoscope, they do not exhibit that relief which is so striking in pictures taken in cameras placed farther apart. Now, as the human eyes are only separated by a distance of 2½ inches, the fact above stated has excited much attention and inquiry, ending in controversy. Mr. Mascher tells us that an explanation may be found in the fact, that the lenses of the camera are much larger than the eyes, and he infers that the distance separating the camera ought to be increased in proportion as their lenses are larger than the eyes. In the course of his experiments, he took a camera and reduced the opening by which light entered to a diameter of one-eighth of an inch, that being the diameter of the diaphragm of the human eye. He found that the focal range of the lens was thereby greatly increased. He then removed the lenses, and discovered that the pictures of external objects thrown upon the ground glass of the camera were very clear and distinct. Substituting a metal diaphragm, with an opening one-fiftieth of an inch in diameter, for the paper diaphragm of an eighth of an inch in diameter, he obtained an excellent picture upon a prepared daguerreotype plate, without the intervention of a lens. His next proceeding was to make two apertures one sixty-sixth of an inch in diameter in the same camera, and the images were thrown on the same plate. After twenty minutes' exposure, good pictures were produced. These pictures possessed the proper amount of relief in the stereoscope; but, being taken on the wrong side of each other for this purpose, it was necessary to cut the plate into two, and reverse their relative position.

New Agent of Motion.—It is stated, in an American periodical, that experiments have been tried at New York as to the efficacy of bisulphuret of carbon as a motive agent, and that such experiments prove the superiority of the vapour of this substance over steam. Bisulphuret of carbon is made by raising charcoal to a red heat in a retort, and then introducing small pieces of sulphur. The bisulphuret passes off in the shape of vapour, which condenses into a liquid on being passed in a pipe through cold water. It is a combustible compound, igniting with a flash, but without a violent explosion. The engine experimented with was small, and constructed, like a common steam engine, with an outside condenser. An experiment was first tried with steam generated by 7 oz. of alcohol. The engine at 12 lbs. pressure made 1285 revolutions with a friction brake on, and the weight placed four inches from the fulcrum. With bisulphuret of carbon the engine made 1652 revolutions with the like quantity of alcohol as fuel, pressure 35 lbs., and the weight placed on the brake at 12 inches from the fulcrum. It is thus made to appear that the same quantity of fuel caused the vapour of bisulphuret of carbon to exert three times more pressure than steam. Capt. Ericssen is still agitating the question of the practicability of his scheme. He set off with his vessel on a voyage from New York to Liverpool, on the 16th of June, leaving at the same time as the *Washington*, an old and slow steamer, destined for the same port.

LAW REPORTS OF PATENT CASES.

The Queen *v.* Hancock. India-Rubber.—This was the trial of a *scire facias* to repeal the well-known patent obtained by Mr. Thomas Hancock on the 21st November, 1843, for vulcanizing india-rubber. The real prosecutor was Mr. Goodyear of the United States of America, whose discovery of the vulcanizing process was previous to Hancock's, though his patent in this country was posterior to the latter's. The manufacture of prepared india-rubber has now become very valuable, the demand for it, in consequence of the variety of its uses, being very great. Goodyear finding that he could not work his patent in this country so long as Hancock's patent was in existence, caused the present proceeding to be taken, and the trial came on before Lord Campbell and a special jury, at Guildhall, on the 7th July, occupying that and a subsequent day. The facts elicited were these:—In the year 1843, Hancock was much employed in making experiments with caoutchouc, chiefly for the purpose of depriving it of its clammy adhesiveness, and in the course of these experiments had tried the combination of a great number of substances with it, but always mechanically. In some of the experiments, however, the heat of a lamp was employed when sulphur was in contact with thin pieces of caoutchouc, and the result was, that the *change*, *i.e.* the vulcanizing process, was effected. The discovery of the effect of sulphur and heat upon caoutchouc was made about June, 1843, but he went on experimenting, and it was not until some months after this that he had obtained a result of practical value. Shortly before he applied for his patent, an agent of Goodyear called upon Hancock's partners, and exhibited to them some pieces of vulcanized india-rubber which were left with them for the purpose of testing whether they possessed certain desired properties, viz., the resistance to cold, and to the action of oils. Goodyear's agent expressly stated that the pieces were left with Hancock's firm *confidentially*—meaning thereby that they were not to do anything to ascertain the nature of the process by which the improvements had been effected. About the same time other pieces of vulcanized india-rubber were shown to persons in England for the purpose of proving the value of the invention, and of trying to effect a sale of it. The invention was offered to Hancock's firm for £50,000, and negotiations were opened between them and Goodyear, who was requested by them to come to England with the view of securing it by patent, he being informed that the invention was valueless as a purchasable commodity unless patented. Meantime Hancock, on examining the specimens of caoutchouc left with his firm, perceived on one of them traces of sulphur, which came off upon his fingers whilst handling it, and it was this circumstance that led him to try experiments with sulphur, which experiments were attended with the result before described. Hancock thereupon took out the patent which it was the object of the present proceeding to repeal. At the time of the application to the Crown for his patent, Hancock produced to the law officer a paper containing the heads of his invention. Not a word was said in this paper of the combination of sulphur with caoutchouc by means of heat, the only modes of combining the two substances there mentioned being mechanical. It was thereupon argued that at the time of his application, Hancock really knew nothing of the process of vulcanization which he described in his specification, and that he arrived at a knowledge of this process some time between the date of the patent and the date of the specification. If this could have been made out, of course the patent would have been void; but the inference attempted to be drawn was distinctly negatived by Hancock, who stated that he was acquainted with the process at the time he applied for the patent. Having obtained his patent, Hancock procured the assistance of Professor Graham, now Master of the Mint, who commenced a series of experiments for the purpose of accurately ascertaining the degree of heat required to form the best combination of caoutchouc and sulphur, the length of time for which the heat should be applied, and other particulars connected with the subject. Mr. Graham stated that, at the time Hancock called upon him (early in 1844), he was acquainted with the process of vulcanization, and produced to him some pieces of vulcanized material. He himself had never heard of the process before. His services were required as a chemist, in order to assist in the preparation of the specification, which instrument he perused and settled. In his opinion, and in the opinion of the other scientific men examined, it was quite impossible for a man, however good a chemist he might be, to discover from mere inspection of vulcanized specimens by what means sulphur had been combined with caoutchouc, to predict the result of combining sulphur with caoutchouc by means of heat, or to guess what the result of applying heat to caoutchouc and sulphur in contact would be. An entirely new product was obtained, but in what consisted the mutual action of the two substances no one had yet discovered. Goodyear stated that he began his experiments with caoutchouc as far back as 1835; that he first became acquainted with the vulcanizing process in 1839, and the discovery was his own. His method comprised the combination of white lead as well as sulphur with caoutchouc. He believed that the white lead had a beneficial effect in the vulcanizing process, though many able chemists said that it really had no effect at all. His own patent was not taken out until January, 1844, want of money being the principal reason of the delay. Hancock's patent contains three claims. 1. The combination of silicate of magnesia and other substances with caoutchouc, in order to overcome the clammy adhesiveness. This part of the invention was not contested. 2. A mode of combining asphalte with caoutchouc for the same purpose. 3. The vulcanizing process. With regard to the second claim, it was shown that one Fanshawe had taken out a patent for combining asphalte with caoutchouc in 1841, and it was asserted that Hancock's process was substantially the same as Fanshawe's, although the latter proposed to make an adhesive mass, and the object of the former was to remove the adhesiveness of india-rubber. As this point involves a comparison of the two specifications, it was reserved by the Judge, and it will come on for argument before the Court hereafter. The main contest, however, was as to the invention of the vulcanizing process. In respect to this invention, it was attempted to be shown on the part of the prosecutor—1. that at the time Hancock applied for his patent, he was ignorant of the process; 2. that he had obtained a knowledge of the process from Goodyear; 3. that there had been a publication of Goodyear's invention in England previous to the date of Hancock's patent, since specimens of vulcanized india-rubber sent from America had been submitted to the inspection of various persons in this country. These specimens had not indeed been offered for sale, but the invention itself was so offered. The jury returned a verdict for the defendant, thereby establishing the validity of Hancock's patent. And thus is afforded another instance of a patent passing safely through the dangerous ordeal of a *scire facias;* unless the Court should decide that Hancock's mode of combining asphalte with caoutchouc is substantially the same as Fanshawe's, in which case Hancock's patent will be invaded, our readers being, doubtless, fully aware that if one part of a patent is bad, the whole is bad.

Booth *v.* Kennard: Oil Gas.—This was an action for infringement, tried at Guildhall, before Chief Baron Pollock and a special jury. The plaintiff obtained his first patent, under which he now claimed, in 1850. It was for an improved apparatus to be applied to the manufacture of gas from oil. Its novelty consisted in suspending the retort by the neck in a "heat chamber," and in making the interior of the retort an inclined plane in steps, or corrugated. By this means, a greater heating surface and a more equable heat were obtained than under the old system, whereby the oil was dropped on to stones or brick-ends placed at the bottom of the retort, which, instead of being suspended in the midst of fire, rested upon brickwork. The second patent was taken out in 1851, and involved a claim for making gas direct from oleaginous seeds and other vegetable substances, instead of first extracting the oil, and then making the gas therefrom. According to the plaintiff, gas thus made was purer and better than any other, and it possessed this advantage, that every housekeeper and farmer growing rapeseed could be their own gasmakers, by means of a portable apparatus. The defendant, Mr. Kennard, is a civil engineer, residing in Duke Street, Adelphi, and the plaintiff alleged that he, carrying on business under the name of the British and Foreign Vegetable Gas Company, had infringed his patents by making and selling an apparatus and materials for the purpose of making gas direct from seeds, the retort in such apparatus being suspended in the same manner as under the plaintiff's first patent. Before, however, evidence of such infringement had been given, his Lordship expressed an opinion to the effect that the second patent was void, inasmuth as the plaintiff thereby claimed for making gas direct from seeds by any process whatever. This, his Lordship said, was fettering skill and genius for fourteen years, although a more simple process might be invented. The plaintiff's counsel thereupon tendered a bill of exceptions to the ruling of the learned Judge, so as to have the opinion of the Court of Error upon it. The verdict was thereupon taken for the defendant as to the second patent, subject to the bill of exceptions, and as to the first patent, the jury were discharged from giving any verdict by consent of the parties.

Privy Council, July 16. Normandy's Patent. Soap.—Dr. Normandy obtained a patent in September, 1841, for improvements in the manufacture of soap, consisting in the use of sulphate of soda, whereby the inferior kinds of soap, termed *weak goods*, made from grease and resin, were much improved. By using this salt, materials not otherwise usable were turned to account, and, these being cheap, the price of soap was greatly diminished. Shortly after the date of the patent, the Board of Excise subjected soap thus made to the highest rate of duty, and the patent became thereby valueless. In 1852, the heavy duty was withdrawn, and he resumed the manufacture, and had granted some licenses. The importance of the invention having been shown, and the loss sustained by working the patent, the Judicial Committee of the Privy Council granted an extension of three years.

Juckes' Patent: Smoke.—Mr. Juckes obtained a patent in September, 1841, for improvements in furnaces and fireplaces, making provision for the consumption of smoke. The efficiency of the apparatus employed, its economy in the consumption of fuel, and the inadequate return to the inventor having been proved to the satisfaction of their lordships, a prolongation for three years was granted.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded March 13.

558. Anguste E. L. Bellford, 32 Essex-street, Strand—Improvements in musical wind instruments.—(Communication.)

Recorded March 20.

627. Henry T. Williams, Archway, Guildford-street, and Keppel-mews North, Russell-square—An improved method of making an easel.

Recorded April 25.

922. Alfred Crosskill, Beverley—Improvements in machinery for cutting and reaping corn, grass, and other crops.
935. François J. Anger, 16 Stamford-street, Blackfriars-road—Invention of a new metallic alloy.—(Communication.)

Recorded April 27.

952. Emile Muller, Joseph Gilardoni, and Xavier Gilardoni, Paris—Invention of a grooving and clamping hooked tile, by means of which the entire covering of a roof is tied together; a machine for the fabrication of such tile, by which it is continuously delivered from the mould through a peculiar system of delivery, applicable to any matter that may be moulded, and a conterminous succession of furnaces for its burning.

Recorded May 1.

974. George W. Knocker, Bushy Ruff, Dover—Improvements in motive power by means of water and air.

Recorded May 9.

1046. Samnel C. Lister, Bradford—Improvements in treating old ropes, also old canvas and gunny bags, and similar materials, part of which improvements are also applicable to hemp, flax, rhea, and other similar fibre, to render parts of the fibres suitable to be spun.

Recorded May 16.

1101. Wilfred Latham, Liverpool—Improvements in cutting the terry or pile of certain textile fabrics used for saddle covers.

Recorded May 17.

1119. William Smith, 10 Salisbury-street, Adelphi—A new machine for cleaning cotton and other fibrous materials.—(Communication.)

Recorded May 21.

1126. Robert J. Stainton and Edmnnd C. Davey, 14 Holland-street, Blackfriars-road, Southwark—Improvements in the construction of warming and other stoves for generating and radiating heat, and also for economizing combustion therein and attention thereto.
1127. Walter H. Tncker, Fleet-street—Improvements in locks.
1128. Peter B. Eassie, Gloucester—Invention of a sectorial or radial elliptograph.
1129. Henry H. Watson, Little Bolton, and James Oliver, Over Hulton, Lancashire—Improvements in the manufacture of fuel.
1130. Benjamin Nicholls, East-street, Old Kent-road—Improvements in the manufacture and construction of buttons.
1131. Panl F. Didot, Paris—An improved process of bleaching paper pulp, textile fabrics, and other substances or matters.
1132. Samnel Stocker, Brighton—Improvements in machinery and apparatus for shaping of metals, and also in such metal goods made from sheets, plates, or tubes, and also for other parts connected therewith, and for finishing the same when left by the machine or apparatus.
1133. Frederick W. Mowbray, Shipley, near Leeds—Improvements in looms for weaving carpets and other pile fabrics.
1134. Thomas Piggott, Birmingham—An improvement or improvements in telescopic gas-holders.
1135. Edward H. Bennett, Birmingham—Improvements in roasting-jacks.
1136. William J. Cnrtis, Hardinge-street, Islington—Improvements in aerostation or aeronautics, and the mechanism connected therewith, which improvements may be rendered subservient to purposes of navigation.
1137. Harry Whittaker, Buffalo, U.S.—Improvements in the propulsion of steam vessels by a direct application of a crank outside the hull to side screw propellers, such application being combined with a high pressure engine also outside of the hull.
1138. Lonis F. I. Ravenstin, and Charles Chatel, Paris, and 32 Essex-street, Strand—Improvements in the manufacture of blinds, screens, reflectors, and other articles of a similar nature.
1139. Ignace-Joseph Silberman, jun., Paris, and 32 Essex-street, Strand—Improvements in printing on any kind of surfaces.
1140. Antoine F. Cossus, Cagliari, Sardinia—Improvements in treating oils and fatty matters
1141. William Longmaid, Victoria Cottage, Stoke Newington, and John Longbottom, Leeds—Improvements in heating coppers, pans, and boilers.
1142. Joseph L. Rey and Adolphe Guibert, Marseilles, France—Invention of a composition to preserve wood and iron, called a submarine and preserving coating.
1143. Thomas G. Shaw, Old Broad-street—An improved conductor to be used in the decantation of wine and other liquids.
1144. Alexander H. Mentha, Manchester—Certain improvements in the manufacture of wadding, and in the machinery or apparatus connected therewith.
1145. William MacNanght, Manchester—Certain improvements in steam boilers or generators.
1146. John M. Murton, 3 Somers-place-west, St. Pancras—Improvements in sister-hooks and thimbles for ships' and boats' riggings, such improvements or parts thereof being applicable also to other purposes where hooks are required.
1147. James Shanks, Arbroath—Improvements in mowing machines.
1148. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in signals for nautical purposes.—(Communication from Henry J. Rogers, Baltimore, U.S.)
1149. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the process of vulcanizing and rendering hard india-rubber and gutta percha, and in the application of those materials when hard to the construction of parts of machinery or apparatus employed in the preparation and manufacture of fibrous materials and textile fabrics.—(Communication.)
1150. Alfred V. Newton, 66 Chancery-lane—Improvements in the construction of watches.—(Communication.)

Recorded May 22.

1151. Henry E. Scott, Brixton—Improvements in ships and other floating vessels.
1152. John Cruickshank, Marcassie, Elgin—An improved construction of offensive and defensive equipment for cavalry.
1153. George Collier, Halifax—Improvements in looms for weaving carpets and other fabrics.
1154. Homer Holland, Westfield, Hampden, Mass., U.S.—Improvements in the method of treating metalliferous sulphurets.
1155. Thomas Holt, Blackburn, and John Sagar, Cabin-end, near Blackburn—Improvement in looms.
1156. Joseph Morgan, Manchester—An improvement in the manufacture of plaited or platted wicks used in the making of candles.

Recorded May 23.

1157. Johan J. Meyer, Rochdale—Improvements in machinery or apparatus for shaping wood and other materials.
1158. Lazare Ochs, St. Josse ten Noode, near Brussels—Improvements in the manufacture of certain kinds of paper from the refuse and cuttings of leather during the operation of tanning.—(Communication.)
1159. James Eden, Lytham, Lancashire—An improved mode of drying fabrics.
1160. Francis Leeshing, Busby, near Glasgow—An improved method of preparing or treating certain dye-stuffs so as to obtain greater dyeing power.
1161. David L. Davis, Dedham, Norfolk, Massachusetts, U.S.—An improved method of applying elastic bearings to railroad chairs and rails.
1162. Thomas M'Low, Staples-inn-buildings, 6 Middlerow, Holborn—Certain improvements in paddle-wheels.
1163. Alfred V. Newton, 66 Chancery-lane—Certain improvements in beehives.—(Communication.)
1164. William Smith, 10 Salisbury-street, Adelphi—Improvements in safety apparatus for mine shafts and other hoists.—(Communication.)
1165. William Smith, 10 Salisbury-street, Adelphi—Invention of a safety apparatus for steam boilers.—(Communication.)

Recorded May 24.

1166. William Smith, Snowhill, and Nathaniel F. Taylor, Gloucester-terrace, Park-walk Chelsea—Improvements in meters for measuring gas and other fluids.
1167. James A. Longridge, Newcastle-upon-Tyne—Improvements in the construction or the manufacture of guns and artillery, and of other vessels intended to resist great pressure.
1168. Auguste F. G. Scegers, Paris, France—Improvements in the manufacture of hangings of paper and of textile fabrics.
1169. John Mitchell and James Entwisle, Bury, Lancashire—Improvements in presser flyers for roving frames and other machines of the like nature.
1170. James Park, Bury, Lancashire—Improvements in machinery for manufacturing paper pulp.
1171. Joshua Hudson, Laurel-place, Queen's-road, Dalston, and George R. Williams, Stanley-street, Chelsea—Improvements in water meters, which are applicable also for the measurement of other fluids.
1172. Charles Rawlings, Sherborne, Dorset—Improvements in writing-desks.
1173. George W. Muir, Glasgow, and Matthew Gray, Bonhill, Dumbartonshire—Improvements in admitting and regulating the admission of air to furnaces.
1176. Oliver R. Chase, Boston, but now of 17 Cornhill—A machine for making confectioners' "pipe," and for other purposes.
1178. Thomas M'Low, Staples-inn-buildings, 6 Middlerow, Holborn—Certain improvements in paddle-wheels.
1179. Joseph Addenbrooke, Bartlett's-passage—Improvements in machinery for folding envelopes.
1180. George Horrocks, Pilkington, Lancashire—Certain improvements in shuttles.

Recorded May 25.

1181. Edwin Haseler, Wolverhampton—An improvement or improvements in frames for pictures, drawings, engravings, and other similar articles.
1182. Thomas M. Greenhow, Newcastle-upon-Tyne, Northumberland—Improvements in constructing and protecting the bottoms and sides of iron ships.
1183. Alexander Melville, 50 Baker-street, Portman-square—Improvements in breech-loading fire-arms, and in projectiles used therewith.
1184. Léon de Parienté, 123 Rue de Brabant, Schaerbeck, near Brussels, Belgium—Improvements in cutting or sawing wood.—(Communication.)
1185. Joseph H. Poullain, Paris, and 32 Essex-street, Strand—A new or improved pen-holder.
1186. Edward Aldridge, Boston, Lincolnshire—Improvements in meters for measuring the flow of liquids and fluids, which can also be employed for obtaining motive power, and in taps for regulating the flow of liquids.
1187. Henry H. Henson, Parliament-street—An improvement in the manufacture of fabrics suitable for goods' wrappers, and other purposes for which canvas has been or may be employed.
1188. John Allen and William Allen, Wallsend, near Newcastle-on-Tyne—An improvement in applying heat to alkaline solutions, and to drying and making alkaline salts.
1189. Auguste P. Jaccard, St. Croix, Switzerland—An improved independent centre seconds' movement for watches.—(Communication.)

Recorded May 26.

1190. Robert W. Waithman, Bentham-house, York, and Joseph Waithman, Manchester—Improvements in machinery or apparatus for the manufacture of lint or similar substances.
1191. Frederick H. Maberley, Stowmarket, Suffolk—Improvements in fire-arms.
1192. John L. Lóránd, 11 William-street, Hampstead-road—An improved railway break.
1193. Thomas Mather, Preston—Improvement in the construction of pistons.
1194. Robert Maclaren, Glasgow—Improvements in furnaces, and in the consumption or prevention of smoke.
1195. William S. Young, Leith—Improvements in steam boiler furnaces, and in the prevention of smoke therein.
1196. John Aspinall, Fenchurch-street—Improvements in machinery for extracting moisture from substances, and for separating liquid from solid bodies, applicable to the refining of sugar, drying of goods, and to purposes for which centrifugal machines are employed.
1197. Alfred I. H. Parent, Paris—Certain improvements in manufacturing buttons, nails, and metallic and plastic articles.
1198. Jean C. Ricu and Carlo Bartocci, Fulingo, Papal States—A new beverage.
1199. Charles W. Harrison, Woolwich—Improvements in metal ropes, cables, and rods, and in machinery for manufacturing the same.
1200. Auguste E. L. Bellford, 32 Essex-street, Strand—Improved machinery for making envelopes.—(Communication.)
1201. Auguste E. L. Bellford, 32 Essex-street, Strand—Invention of a new apparatus for regulating the speed of steam-engines.—(Communication.)
1202. Théodore M. Rabatté and Jacques Rettig, Paris, and 32 Essex-street, Strand—Improved machinery for bruising, graining, or currying leather, skins, or hides.
1203. John Avery, 32 Essex-street, Strand—Improvements in apparatus for conveying heavy weights for bridge building and other purposes.—(Communication.)
1204. David Methven, 9 Pembroke-cottages, Caledonian-road, Islington—Improvement in the manufacture of stoppers for bottles and other vessels.
1205. Gottlieb Neuffer, 39 Finsbury-square—An improved mode of producing patterns upon floor-cloths and other ornamental coverings for floors, walls, tables, and other surfaces.

1206. François T. Botta, Paris—A new construction of furnaces called mixed furnaces, participating of the heating by the solid fuel, and by the combustion of the gaseous products.

1207. Thomas Waterhouse, Claremont-place, Sheffield—Improvements in the means of actuating forge and other hammers, which improvements are also applicable to pile-driving and other like purposes.—(Communication.)

1208. Auguste E. L. Bellford, 32 Essex-street, Strand—Improved machinery to be used in preparing flax, hemp, and other fibrous matters.—(Communication.)

Recorded May 28.

1209. Joseph B. Howell, Sheffield—A new or improved mode or modes of consuming more effectually the gas and gaseous products evolved during the combustion of fuel.

1210. Samuel Rowlands, Birmingham—A new or improved instrument or apparatus to be used for purifying or otherwise treating gas.—(Communication.)

1211. Benjamin Fullwood, 6 Kirby-street, East India-road, Poplar—Improvements in the purification of mineral, vegetable, and animal matters containing oily, bituminous, resinous, ammoniacal, and aqueous qualities.

1212. Edward G. Swinton, Warsash House, near Titchfield, Hampshire—Improvements in applying motive power for grinding corn, and for other similar purposes.

1213. John Morrison, 10 Arlington-square, New North-road, Islington—Invention of a new mode of constructing railways, specially intended to be employed for the transit of carriages or vehicles moved or propelled by human power.

1215. Eugène M. Roch, Paris, and 32 Essex-street, Strand—Improved apparatus for reading or bringing into sight, bills, advertisements, papers, maps, and similar objects.

1216. Frédéric de Moriès, Montmartre, near Paris, and 32 Essex-street, Strand—Improvements in obtaining motive power.

1217. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in sewing machines.—(Communication.)

1219. John Whitehead, jun., and Robert K. Whitehead, Elton, near Bury—Improvements in finishing woven fabrics.

1220. Thomas Partridge, Birmingham—Improvements in the constructing of artificial legs.

1221. Henry Grafton, Rolles-buildings, Fetter-lane—Improvements in apparatus for heating and cooking.

1222. Richard Coleman, Chelmsford—Improvements in the construction of land rollers, and in implements for ploughing and breaking up or scarifying the soil.

Recorded May 29.

1223. Daniel Dunn, 9 King's-road, Pentonville—Improvements in steam-boilers.

1224. Jean B. Acklin, Paris—Improvements in the mode of substituting paper to pasteboards in jacquard looms.

1225. Etiénne J. Lafond and Count Louis Alfred de Chatauvillard, Belleville, near Paris—Improvements in the processes of and apparatus for treating mineral, animal, and vegetable matters for obtaining oils, essences, paraffine, and other similar products.

1226. Edward J. Payne, Birmingham—Improvements in the manufacture of covered thread.—(Communication.)

1227. Ellis Clowes, King's Bench-walk, Temple—An improved construction of spring for resisting sudden and continuous pressure.—(Communication.)

1228. William Langshaw, Eagley, near Bolton, and George and William Jelley, Leicester—Improvements in machinery for manufacturing fancy fabrics with both sides alike.

1229. Thomas V. Lee, Prospect-cottage, Dulwich, Surrey—Improvements in generating steam in marine and other boilers.

1230. George Rogers, Alfred-place-west, Thurloe-square, Brompton—Improvements in apparatus for retaining and drawing off aerated liquors.—(Communication.)

1231. William A. Henry, Bruce Works, Bridge-street, Sheffield—Improvements in vices, and in the mode of securing the same to work-benches.

1232. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in casting metals.—(Communication from Jackson Brothers, Petin Gaudet, and Company, Rive de Gier, France.)

1233. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in stamping and embossing presses.—(Communication from Carl H. O. Fänger, Graefrath, Prussia.)

1234. Thomas M'Low, Staples-inn-buildings, 6 Middlerow, Holborn—Improvements in screw-propellers.

Recorded May 30.

1235. Robert D. Aked, 28 Matilda-street, Caledonian-road, Islington—Improvements in the construction of stands for supporting crotchet reels when in use.

1236. Alfred V. Newton, 66 Chancery-lane—An improved calculating apparatus.—(Communication.)

Recorded May 31.

1237. Emanuel Wharton, 1½ William-street, Birmingham—Improvements in ordnance and fire-arms.

1238. Emanuel Wharton, 1½ William-street, Birmingham—Improvements in the machinery for manufacturing metal tubes.

1239. Emanuel Wharton, 1½ William-street, Birmingham—Improvements in steam-engines.

1240. John L. Jullion, Combe House, Tovil, Kent—Invention of the manufacture of paper, card, and millboard from certain vegetable productions.

1241. James Leetch, Westminster—An improved construction of helmet or head-dress.

1242. William Rimington, jun., Skipton, in Craven, Yorkshire—Invention of a new spring hinge for swing doors.

1243. Charles T. Dunlop, Glasgow—Improvements in the manufacture of chlorine.

1244. Sir John W. Lubbock, Bart., Mansion House-street—An improvement applicable to telescopes and other similar optical instruments.

1245. Hermann Sachs, Newgate-street—An improved construction of fountain pen.

1246. Samuel Bickerton, Oldham—An improved oil lubricator.

1247. Antoine B. Alfred, Baron Espiard de Colonge, Paris, and 32 Essex-street—An improved diving apparatus.

1248. Robert Ashworth and Samuel Stott, Rochdale—Invention of certain appendages to and improvements in machinery for preparing, spinning, doubling, twisting, and winding fibrous substances.

1249. Thomas Worsdell, Birmingham—Improvements in lifting jacks.

1250. Richard A. Brooman, 166 Fleet-street—Improvements in dyeing cotton, threads, yarns, and twists.—(Communication.)

Recorded June 1.

1251. Adrien Jackson and Eli Kershaw, Manchester, and Joseph Roberts, Failsworth, near Manchester—Improvements in looms for weaving.

1252. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and Paris—Certain improvements in the treatment of vegetable and animal oils.—(Communication.)

1253. Richard Peyton, Bordesley Works, Birmingham, and Alexander S. Stocker, Poultry—Improvements in the manufacture of bedsteads.

1254. Charles I. C. Venant, Amiens, France—Improvements in apparatus for roasting [illegible]

1255. John C. Pellenz, Aix-la-Chapelle, Prussia—Improvements in the manufacture of iron wheels.

1256. Richard Whytock, Edinburgh—Improvements in colouring yarns or threads intended to form elements of various loom fabrics, and for crotchet work and knitting.

1257. Henry Spencer, Rochdale—Improvements in machinery or apparatus for twisting and winding spun yarns or threads.

Recorded June 2.

1258. John Boyd, Ashbocking, Suffolk—Improvements in letterpress printing machines.

1259. John Lane, Liverpool, and John Taylor, Birkenhead—An improved engine.

1260. James Taylor and William Smith, Manchester—Improvements in the chairs of railways.

1261. Clement Coe, Manchester—Improvements in the mode or method of manufacturing druggets, bockings, pilot cloths, blankets, or similar strong materials.—(Communication.)

1262. Charles Little, Derby—Improvements in machinery or apparatus for the manufacture of envelopes.

1263. Henry Cartwright, of the Dean, Broseley, Salop—An improved steam-cock.

1264. François C. Armelin, jun., Draguignan, France—Certain improvements in ploughs.

1265. Henry Galante, Paris, and 4 South-street, Finsbury—An improved surgical injection bottle.

1266. James T. Dore, High-street, Southampton—An improved mode of constructing boxes or cases for holding needles, buttons, and other wares.

Recorded June 4.

1267. Mary Staite, Liscard, Cheshire—Invention for the manufacture of a new black paint.

1268. Peter A. Godefroy, 3 King's Mead-cottages, New North-road, Islington—Improvements in the treatment of gutta percha.

1269. George H. Ingall, Bartholomew-lane, Bank—Improvements in coupling railway carriages.

1270. Horace J. Kaye, 71 Denbigh-street, Belgrave-road, and Percy Burrell, Camberwell-grove—An improved mode of communicating to each of two trains that are in motion the distance they are respectively from each other.

1271. William H. Graveley, 40 Upper East Smithfield, St. Botolph, Aldgate—An improved apparatus for cooking purposes, and improvements for the production o fresh water for ship and land use.

1272. William Eley, 38 Broad-street, Golden-square—An improvement in the manufacture of detonating caps for fire-arms.

1273. Edmund Morewood and George Rogers, Enfield—Improvements in coating sheets of wrought-iron.

1274. George Green, Mile-End-road—Improvements in sawing machinery.

1275. William E. Newton, 66 Chancery-lane—An improved construction of ships' auger.—(Communication.)

Recorded June 5.

1276. Francis Puls, Soho-square—Improvements in electro-coating iron.

1277. John Gedge, 4 Wellington-street South, Strand—Improvements in combs called currycombs.—(Communication from Mr. F. V. Vauconsant, Metz, France.)

1278. John Gedge, 4 Wellington-street South, Strand—Improvements in securing the contents of bottles or other similar vessels.—(Communication.)

1279. John Gedge, 4 Wellington-street South, Strand—Improvements in the distribution of motive power.—(Communication from Emile Grill, Beziers, France.)

1280. David N. B. Coffin, jun., Massachusetts, U.S.—A new and useful improvement in self-closing stop-cocks.

1281. Thomas Barrows, Massachusetts, U.S.—Improvement in the treatment of wool preparatory to its being carded, spun, or woven.

1282. Cyrus Curtice, Massachusetts, U.S.—A new and improved light alarm or burglar annunciator or apparatus, to give alarm when a burglarious attempt is made to enter a room or dwelling.—(Communication.)

1283. Thomas Barrows, Massachusetts, U.S.—Improvement in the treatment of wool.

1284. Ethan Allen, Massachusetts, U.S.—An improved breech-loading fire-arm.

1285. John Tenwick, 24 Orchard-hill, Lewisham-road—Improvements in water guages for steam boilers.

1286. William E. Newton, 66 Chancery-lane—Improved machinery for rolling bar-iron.—(Communication.)

Recorded June 6.

1288. John Gedge, 4 Wellington-street South, Strand—Improvements in the means of preserving grain.—(Communication.)

1289. John Gedge, 4 Wellington-street South, Strand—Improvements in the manufacture of flat tiles.—(Communication.)

1290. John Fielding and William Hopwood, Blackburn—Improvements in looms.

1291. Paulin Lolmède, Saux, Département du Lot, France—Invention of a new instrument for the administration of medicinal substances.

1292. George Hopper, Houghton-le-Spring Iron Works, Durham—Improvements in rolling and shaping metals.

1293. Henry Leech, James Robinson, and Richard Burrows, Preston—Certain improvements in machinery or apparatus for spinning cotton and other fibrous substances.

1294. James Robertson, Ardrossan—Improvements in transmitting motive power in certain circumstances where reversing actions are necessary.

1295. Henry Nunn, Mahledon-row, Burton-crescent, New-road—Improvements in the construction of carriages for invalids and children, part of which improvements is also applicable to street cabs and other carriages.

1296. John Boucher, 3 Surrey-villas, Camberwell New-road—Improvements in powder flasks, and in the sights and ramrods of fire-arms.

1297. William Baines, Coverdale-terrace, Hunter's-lane, near Birmingham—Improvements in certain parts of railways, and for the methods of manufacturing and constructing part of the same.

Recorded June 7.

1298. Pierre A. Favre, 4 South-street, Finsbury—Certain improvements in employing the residue arising from the lixiviation of crude sodas.

1299. John Ramsbottom, Longsight, near Manchester—Improvements in safety valves and feeding apparatus for steam boilers.

1300. John Buncle, Springfield, Linlithgow—An improvement in bleaching resinous substances (calophane) for the manufacture of soap.

1301. Moses Heap, Blackburn, Lancashire—Certain improvements in machinery or apparatus for grinding dyewoods or roots, and for other similar pulverizing purposes.

1302. Thomas Ogden, Manchester—Certain improvements in machinery or apparatus for spinning cotton and other fibrous materials.

1303. André Orange, Edinburgh—Improvements in obtaining representations for commercial purposes of articles for sale.

1304. John A. Reynolds, Elmira, New York, now residing at the Tavistock Hotel, Covent-garden—Improved machinery for discharging volleys of shot.

1305. Diederich Fehrman, Liverpool—Improvements in lamps.—(Communication.)

1306. Charles C. J. Guffroy, Lille, France—An improved smoke-consuming apparatus.

1307. Richard A. Tucker, Lenton, Nottinghamshire—Invention for using the gas and smoke arising from coal or other substances during the process of combustion for fuel.
1308. Richard Peters, Union-street, Southwark—Improvements in the manufacture of ordnance shells and other hollow vessels.

Recorded June 8.

1309. Robert Cannce, Bolton-le-Moors—Improvements in machinery for sizing, dressing, and warping yarn.
1310. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and 39 Rue de l'Echiquier, Paris—Certain improvements in the manufacture of iron shovels.—(Communication.)
1311. Frederick Weaver, Handsworth, Staffordshire—Improvements in machinery for grinding or crushing bones and other substances.
1312. Isaie Lippmann, Paris—Improvements in the treatment of hides and skins for the manufacture of leather.
1313. George F. Chantrell, Liverpool—Improvements in apparatus applicable to the manufacture and revivification of animal or vegetable charcoal.

Recorded June 9.

1314. Henri Sibille, Paris—Improvements in the decortication and preserving of grain and seeds.
1315. John S. Nettlefold, Edward J. Nettlefold, and Joseph H. Nettlefold, Holborn—Improvements in locks.—(Communication.)
1316. Etienne J. Lafond and Count Louis Alfred de Chatauvillard, Belleville, near Paris—Improvements in apparatus for lighting.
1317. Henry Teague, Lincoln—Improvements in high and low pressure meters for water, gas, or any other fluid.
1318. Cromwell F. Varley, 1 Charles-street, Somers-town, St. Pancras—Improvements in electric telegraphs.
1319. Thomas Bright, Carmarthen, South Wales—Improvements in apparatus for the prevention of waste in water or other fluid supplies.
1320. Masta J. Cooke, Newcastle-upon-Tyne—Invention for preserving provisions and vegetables suitable for armies in the field, for vessels on long voyages, and other purposes, and also for the necessary apparatus for preserving and preparing the same for food.
1321. Joseph Robinson Poplar—Improvements in tables.
1322. John Greenwood, Irwell Springs, Bacup, Lancashire—Improvements in purifying oils.
1323. Samuel Colt, Pall-mall—An improvement in the construction of fire-arms.
1324. Samuel Colt, Pall-mall, and William T. Eley, Broad-street, Golden-square—Improvements in the manufacture of cartridges.

Recorded June 11.

1325. William K. Hall, Mark-lane—Improvements in brakes for railway carriages.
1326. Henry B. Barlow, Manchester—Improvements in certain parts of machines, and in slubbing and roving cotton and other fibrous materials.—(Communication.)
1327. Frederick C. Bakewell, 6 Haverstock-terrace, Hampstead—Improvements in bench planes.—(Communication from William S. Hopper, U.S.)
1328. John D. Kind, Birmingham—Improvement or improvements in spindles for locks and latches, and in attaching knobs or handles to the said spindles.
1329. Joseph L. Casartelli, Manchester—Improvements in pressure and vacuum guages.
1330 Edward V. Gardner, 24 Norfolk-street, Middlesex Hospital, and John H. Walker, Cole-street, Dover-road—Improvements in separating cotton, flax, hemp, jute, and other vegetable substances, from manufactured fabrics containing wool, and in preparing the wool for remanufacture.
1331 William Barrington. Limerick, and William R. Le Fanu, Dublin—An improved mode of joining bridge rails in the permanent way of railways by means of a fish piece.
1332. Frederick T. S. Bardo, Royal Exchange—An improvement in cases for carrying tickets, cards, and other like articles.
1333. John H. Johnson, 47 Lincoln's-inn-fields. and Glasgow—Improvements in metallic pens.—(Communication from Samuel Barbot, Paris, and Louis C. Riottot, l'Isle Adam, France.)
1334. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in governors or regulators for prime movers.—(Communication from François T. Moison, Mony, France.)
1335. Isaie Lippmann, Paris—Improvements in dyeing or colouring the hides and skins of animals.

Recorded June 12.

1336. John J. Liebisch, London—Improvements in rails for railways.
1237. William Armitage, Manchester—Improvements in the manufacture of union bags and sail-cloth.
1338. Nathan Hackney, Hull—An improvement in the manufacture of earthenware, china, and porcelain.
1339. Samuel Coulson, Sheffield—An improvement in the preparation of sulphate of baryta, and in the manufacture of glass when sulphate of baryta is used.
1340. William B. Johnson. Manchester—Improvements in steam boilers and safety valves.
1341. Thomas Metcalfe, High-street, Camden-town—An improved mode of manufacturing collapsible hats and bonnets.
1342. Charles Parker, Dundee—Improvements in weaving.
1343. Henry W. Ford, Gloucester—Improvements in machinery or apparatus for effecting agricultural operations.
1344. John C. Brant, 8 Surrey-square, Old-Kent-road—Improvements in laying rails, chairs, and sleepers for the permanent way of railways.

Recorded June 13.

1345. Frederick C. Bakewell, 6 Haverstock-terrace, Hampstead—Improvements in apparatus for supplying furnaces with hot air.—(Communication.)
1346. Frederick C. Bakewell, 6 Haverstock-terrace, Hampstead—Improvements in rotating breech fire-arms.—(Communication.)
1347. John Avery, 32 Essex-street, Strand—Improvements in oscillating steam-engines.—(Communication.)
1348. William J. Blackman, of the Hippodrome, Kensington—Invention of a new medicine or sirup for the cure of coughs.
1349. Edward R. Turner and Frederick Turner, St. Peter's Foundry, Ipswich—Improvements in machinery or apparatus for crushing and grinding grain, seeds, and pulse.
1350. William Moxon and John Clayton, Rochdale—Certain improvements in looms for weaving carpets or other looped fabrics.
1251. Henry H. Henson. Parliament-street—Improvements in the construction of portable and other buildings, and in the means of ventilating buildings.
1352. Joseph Betteley, Liverpool—An improvement in the manufacture of iron knees for shipbuilding.
1353. Joseph Betteley, Liverpool—An improvement in ships' anchors.
1354. George Cottam, Winsley-street, Oxford-street—Improvements in hay racks and harness brackets.
1355. George A. Biddell, Ipswich—Improvements in the manufacture of machines for cutting or grinding vegetable and other substances.
1356. Edwin Lodge, Mirfield, Yorkshire, and George Marshall, Huddersfield—Certain improvements in the production of animal and vegetable naphtha, ammonia, and charcoal, and also for the evolution of the carburetted and olefiant gases therefrom.

Recorded June 14.

1357. Godfrey Sinclair, Regent-street—Improvements in signalling between the engine drivers and the guards of railway trains.
1358. Ebenezer Hollis, Birmingham—A new or improved method for securing ramrods to fire-arms.
1359. Joseph Enouy, 31 Denbigh-place, Pimlico—Invention of the means of "removal" of every rotary or revolving "barrel or cylinder" containing chambers from all revolver pistols, guns, and fire-arms, and the "substitution" in their place by another and other "barrels or cylinders" in succession.
1360. Alexander Robertson, St. Mary, Islington—Invention of a new manufacture of packages for dry or moist goods or liquids.
1361. Felix Leloup, Paris—Certain improvements in treating textile fabrics or substances for separating cotton or other vegetable substances from wool, silk, and other animal products.—(Communication.)
1362. Samuel C. Lister, Manningham, Bradford—Improvements in treating silk waste, also the noils of silk, wool, and goats' wool or hair, before being spun.
1363. James T. Chance, Birmingham—Improvements in glass flattening furnaces.—(Communication.)

Recorded June 15.

1364. William Hewitt, Bristol—Improvements in propelling vessels.
1365. William Clay, Liverpool—An improved manufacture of bar-iron.
1366. William Clay, Liverpool—Invention for the application of certain descriptions of bar-iron to purposes where great strength or stiffness is required.
1367. Henry Bridgewater, Alfred-place, Bedford-square—An improved construction of spike for railway and other purposes.
1368. William Lee, Duke-street—Improvements in water-closets.
1369. Hippolyte Mathis, 42 Rue Notre Dame des Victories, à Paris—Improvements in preserving wood.—(Communication.)
1370. John H. Sadler, Lady Pitt-lane, Hunslet, Leeds—Improvements in looms for weaving.
1371. George F. Morrell, Fleet-street—An improvement in ink bottles or ink vessels.

Recorded June 16.

1372. Dumont Pallier, Broad-street, Lambeth—Improvements in the manufacture of soap or saponaceous substances.
1373. William Jones, Birkenhead—Improvements in machinery for punching and shearing plates of metal, which improvements are also applicable to stamping and pressing metals and other substances.
1374. James Webster, Birmingham—A new or improved balance.
1375. Lazare F. Vaudelin, Upper Charlotte-street, Fitzroy-square—Improvements in railway breaks or brakes.
1376. James Lowe, East Greenwich—Improved apparatus to be employed in place of paddle-wheels or ordinary stern propellers for propelling vessels.

Recorded June 18.

1377. John Sellars, Monsall House, near Manchester—Improvements in the manufacture of starch, and in the use of substances employed therein.
1378. Isidore Carlhian and Isidore Corbiere, 27 Castle-street, Holborn—Improvements in moderator lamps.
1379. Louis H. Réal, Paris—Certain improvements in elastic bottoms or seatings for beds, mattresses, and seats.
1380. Richard Peaker, Methley, and Thomas Bentley, Wakefield, Yorkshire Improvements applicable to machinery for grinding wheat and other grain, cement, and other substances.
1381. William H. Wilding, New-road—Improvements in furnaces.
1382. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in screw propellers, and in the shafts and cranks by which they are driven, which improvements are also applicable generally to the shafts and cranks of marine, stationary, and locomotive steam-engines.
1383. William Little, Strand—Improvements in printing machinery.
1384. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of cast steel and mixtures of steel and cast-iron.
1385. Thomas Blanchard, Paris—A new and improved method of bending timber.
1386. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of ordnance.
1387. Henry Francis, 456 West Strand—Improvements in cutting out parts of garments or articles of dress.
1388. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of rolls or cylinders used in the lamination, shaping, and cutting of metals, in crushing ores and other substances, and in calendering, glazing, embossing, printing, and pressing.
1389. Edward Myers, Rotherham—Improvements in machinery or apparatus for raising water or other liquids.
1390. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of railway wheels.
1391. Edward Myers and John W. Potter, Rotherham—Improvements in buffers, draw springs, and bearing springs.
1392. John Jones, Sheffield—Improvements in obtaining motive power.
1393. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in furnaces or fire-places.—(Communication from Nicolas F. C. Desboissières, Paris.)

Recorded June 19.

1394. Charles A. Hartmann, Paris—Certain improvements in the preparation or combination of colours for printing stuffs and textile fabrics.
1395. Jebiel F. Norton, Manchester—Improvements in machinery or apparatus for measuring liquids and fluids, which is also applicable for obtaining motive power.—(Communication.)
1396. Edwin Dixon and Thomas Bailey, Wolverhampton—A new or improved tap or cock.
1397. Francis Burke, Woodlands, Montserrat, B. W. I., at present in London—Improvements in preparing pulp or pulpous material, applicable in the manufacture of paper and for other useful purposes.
1398. John Macintosh, Great Ormond street—Improvements in fuses, fusees, and matches.
1399. Daniel Gover, King-street, Long-acre—Improvements in the construction of gun carriages, and appliances connected therewith.
1400. James Letchford, Duncan-place, Hackney—An improved construction of folding bedstead.
1401. John H. Johnson, 47 Lincoln's-inn-fields, and of Glasgow—Improvements in machinery or apparatus for emptying cesspools and privies.—(Communication.)
1402. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the storing and treatment of grain.—(Communication from Jean G. De Coninck, Havre, France.)
1403. John H. Johnson, 47 Lincoln's-inn-fields, and of Glasgow—Improvements in the manufacture of dish covers, dishes, plates, and other articles of sheet metal, and in the machinery or apparatus employed therein.—(Communication.)

Recorded June 20.

1404. Daniel B. Herts, 17 Cornbill—An improved life-preserving harness.—(Communication from George Yellott and Samuel Hunt, Maryland, U.S.)
1406. Robert B. Longridge, Manchester—Improvements in the construction of steam boilers and malleable iron tubes.
1407. John Green, 27 Charlotte-street, Portland-place—Improvements in oil lamps generally termed moderators.
1408. James Gernon, 14 Buckingham-street, Adelphi—Improvements in the manufacture of articles of clay.—(Communication.)
1409. James Gernon, 14 Buckingham-street, Adelphi—Improvements in the manufacture of plaster of Paris and cement.—(Communication.)
1410. Robert Walker and Alexander M'Kenzie, both of Glasgow—Improvements in electric telegraphs.
1412. Robert W. Savage, St. James-square—Improvements in single and double action swing doors.
1413. Uriah Lane, 46 Regency-square, Brighton—An improvement in the manufacture of pumps.
1414. Elise Cochaud, Paris, and 32 Essex-street, Strand—Improved apparatus to be used in making aerated or gaseous liquids.
1415. Louis Pol, 32 Essex-street, Strand—Certain improvements in piano-fortes.
1416. William E. Newton, 66 Chancery-lane—Improved machinery for polishing or finishing thread.—(Communication.)
1417. Jean F. V. Fabien, Paris—Improved machinery for manufacturing wheels.—(Communication.)

Recorded June 21.

1418. John L. Jullion, Tovil, Kent—The manufacture of paper, card, and millboard from certain vegetable productions.
1419. William C. Wilkins, Long-acre—An improvement in lamps.
1420. Pierre F. Rioux, 103 Fauhourg St. Dennis, near Paris, and Leon de Pariente, 123 Rue de Brahant, Fauhourg of Schaerheck, next Brussels—Improvements in the fixing of metallic ornaments upon paper, flock, leather, cotton, silk, or any other fabrics to which such ornaments may be applicable.—(Communication.)
1421. Matthew Shelley, 12 Union-crescent, Union-street, Kingsland-road—Improvements in cooking utensils.
1422. James R. Birch, 7 Washington-street, Liverpool—An improved boat plug or self-acting valve.
1423. Jacob Ben'Jamin, Leadenhall-street—Improvements in apparatus for the manufacture of gas.—(Communication.)
1424. Theodore Bougereau, 46 Lime-street—Improvements in apparatus for roasting coffee.
1425. Richard Keevil, Lacock, Chippenham—Improvements in vessels used in the manufacture of cheese.
1426. William Baséhé, 2 Mayfield-place, High-street, Kensington—An improvement in the manufacture of paper.
1427. Charles E. Green, 13 Blandford-street, Portman-square—Improvements in huts, tents, and camp hospitals.
1428. Luther Young, Bow-lane, Cheapside—An improvement in the construction of gas regulators.
1429. Thomas C. W. Pierce, Manchester—Certain improvements in machinery or apparatus for finishing yarns or threads manufactured from cotton, silk, flax, or other textile materials.
1430 Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in steam engines for pumping and other purposes, part of which improvements is also applicable to pumps.—(Communication.)

Recorded June 22.

1431. William Teal, Wakefield—An improved method of treating and working soapy or greasy waters, in order to obtain the greasy substances therefrom.
1432. Oliver R. Chase, 17 Cornhill—An improved machine for making lozenges, and for other purposes.
1434. Stephen White, Liverpool—Improvements in washing, cleansing, and drying grain.
1435. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in screw fastenings.—(Communication.)
1436. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in breech-loading fire-arms and cartridges relating thereto.—(Communication.)
1437. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in pulverizing quartz, mineral, and other hard substances.—(Communication.)
1438. John G. N. Allcyne, Butterley Iron Works, Alfreton, Derhy, and Henry Strafford, Codnor Park Iron Works, Alfreton, Derhy—Improvements in railway brakes.
1439. Herbert N. Penrice, Woolwich—Improvements in machinery for propelling vessels.

Recorded June 23.

1440. Stanislas T. M. Sorel, Paris, and 4 South-street, Finsbury—A machine for applying adhesive matters on stuffs, and also for applying on the said matters other substances or stuffs.
1441. Thomas Walker, Birmingham—Improvements in projectiles for ordnance and other fire-arms.
1442. Frederick W. Mowbray, Shipley, near Leeds—Improvements in looms for weaving.
1443. William Pesrce, Poole Iron Foundry, Poole—Improvements in machinery for manufacturing certain articles of pottery, such as pipes, tiles, hollow bricks, and other like articles.
1444. George Whish, Canada Works, Birkenhead—Improvements in oscillating steam engines.
1445. Ignace J. Silbermann, Paris, and 32 Essex-street, Strand—Invention of a new system of manufacturing globes and other printed plane or curve surfaces.
1446. Auguste E. L. Bellford, 32 Essex-street—Improvements in the manufacture of hats for felting, and in machinery for manufacturing the same.—(Communication.)

Recorded June 25.

1447. John Gedge, 4 Wellington-street South, Strand—Improvements in apparatus or mechanism for measuring liquids.—(Communication.)
1448. John Young, Linton, near Morebattle, Roxburghshire—Improvements in and applicable to harrows.
1449. Josiah Harris, Clogwynhyfryd, Dolgelly, Merioneth, North Wales—Invention of a machine and apparatus for crushing, pulverizing metals, metallic ores, metalliferous matters or substances whatever, and for obtaining, washing, dividing, amalgamating metals and other matters or substances contained therein.—(Communication.)
1450. John Page, Perth—Improvements in moulding or shaping metals.
1451. Sydney Smith, Hyson-green Works, near Nottingham—Improvements in apparatus for insuring the correct action of the safety-valves of steam-boilers, and for regulating the action of the dampers of steam-boilers.
1452. Moses Poole, Avenue-road, Regent's-park—An improvement in sculpturing surfaces of marble and stone.—(Communication.)
1453. Perceval M. Parsons, Duke-street, Adelphi—Certain improvements in moulds for casting metals.

Recorded June 26.

1454. Auguste E. L. Bellford, 32 Essex-street, Strand—Certain improvements in rotary blowing machines, which are also applicable to rotary pumps, to rotary engines, to be driven by steam or other fluids, and to meters for measuring the flow of fluid bodies.—(Communication.)
1455. Thomas B. Sharp, Manchester, and Alexander Yorston, Belfast—Improvements in the arrangement and construction of furnaces or fire-places.
1456. Frederick Leiss and Charles Schneider, Hesse Darmstadt, Germany, now residing at 65 Prince's-street, Leicester-square—Manufacturing 'mica letters,' numerals, shop-signs, figures, arms, devices, and ornaments.
1457. James Ronald, 18 James-street, Liverpool—Certain improvements in machinery for dressing manilla and other hemps and flax.
1458. Moses Poole, Avenue-road, Regent's-park—An improvement in the manufacture of printing rollers or cylinders.—(Communication.)
1459. Benoit Bonuet, Rue des Conronnes, Belleville, near Paris—Improvements in weaving.
1460. François Vennin-Derégniaux, Lille, France—Improvements in the construction of spinning machinery.
1461. Charles M. Pouillet, Paris—Certain improvements in railways.
1462. Joseph J. Bucknall, Liverpool—Improvements in the manufacture of hats and caps, and the employment of certain tools for producing the same.
1463. Felix Raux and Louis Poret, Paris, and 4 South-street, Finsbury—Improvements in the preparation of artificial mineral waters.
1464. James M. Clements, Great Hampton-street, Birmingham—Certain improvements in pockets with spring-lock fastening, applicable to male and female attire, as also as a fastening for bags, reticules, purses, or similar articles.
1465. Henry J. Distin, 31 Cranhourn-street—Improvements in the means of rendering the ordinary field or regulation bugle chromatic.

Recorded June 27.

1466. Frederick Russell, 13 Cumberland-market, Regent's-park—An improved mode of hanging windows and shutters.
1467. Thomas Swinburne, South-square, Gray's-inn—Improvements in machinery for applying and obtaining motive power, applicable, but not exclusively so, in the propulsion of vessels and railway trains.
1468. Denis D. Buhler, Paris, and 4 South-street, Finsbury—Certain improvements in the construction of fencings.
1469. Thomas Lucas, Duston, Northamptonshire—Improvements in the manufacture of iron.
1470. Louis J. F. Margueritte, Paris, and 32 Essex-street, Strand—Improvements in the manufacture of glass and crystal.

Recorded June 28.

1471. Henry Walker, Samhourn, Warwickshire—Improvements in ploughs for ploughing or tilling land.
1472. John Raywood, Wentworth, Yorkshire—An improved method of stopping railway trains.
1473. Charles Moreau-Darluc, Paris—An improved mode of separating substances of different nature or composition by means of displacement and substitution.
1475. Simon Davey, Tucking Mill, Cornwall—An improvement in the manufacture of safety fuzes for mining and military purposes.
1476. Carl C. Engström, 18 Bucking-street, Strand—Improvements in breech-loading ordnance and the balls or projectiles thrown by cannon.
1477. George Lilley, Islington—An improvement in water-meters.
1478. Robert Besley, Fann-street, Aldersgate-street—An improved manufacture of metallic alloy, applicable to the casting of type and other articles.—(Communication.)
1479. John Skelley, Kilcurry, Longford—Improvements in the construction of carriage wheels.
1180. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in manufacturing, lighting, and heating gases.—(Communication.)

DESIGNS FOR ARTICLES OF UTILITY.

Registered from May 25th to June 26th.

May	25th,	3722	J. Wright, Chipping Ongar,—" Tap protector."
	29th,	3723	Smith, Lissons, & Co., Duke-street, Adelphi,—" Heater and part of a kettle."
	31st,	3724	R. Brotherhood, Chippenham,—" Capstan."
June	1st,	3725	C. T. Bright, Liverpool,—" Parallel compass."
	6th,	3726	J. Cuxson and C. F. Lucas, Shiffnall,—" Fire escape."
	9th,	3727	E. Cobbett, Villiers-street,—" Cooking apparatus."
	13th,	3728	Peel, Williams, & Peel, Manchester,—" Compound valve."
	—	3729	J. Hill, Piccadilly,—" Army tent."
	19th,	3730	C. Burton, Regent-street,—" Parasol."
	22d,	3731	W. Mountcastle, Manchester,—" Hat."
	—	3732	Captain J. Olive, Liverpool,—" Valve plug for boats."
	26th,	3733	J. M. Fisher, Taunton,—" Chimney top."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered.

May	29th,	668	J. Edwards, Birmingham,—" Anti-spirt for pens."
	30th,	669	A. Kuisella, Kilkenny,—" Flying machine."
	31st,	670	R. J. Webher, Newton Ahhott,—" Straw shaker."
June	12th,	671	Littlehales & Green, Birmingham,—" Tray edges."
	18th,	672	W. Eades & Son, Birmingham,—" Screw wrench."
	20th,	673	C. Desden, New-road,—" Shirt front."
	23d,	674	F. Wilkins, Harley-street,—" Air cushion."

TO READERS AND CORRESPONDENTS.

S. H.—The mechanical power derived from thermal changes has been applied for adjusting ventilating apparatus, the draught valves of stoves, and other movements demanding but little active force. There is very little chance of turning the power to useful account for severe work of the kind which he mentions. His piston-rod and crank movement is very old, and, what is worse, it is very bad.

A. F.—This is a very different matter. Thirty-two feet is the limit, as the atmosphere, acting on an unbalanced column, will not carry up the fluid higher.

W. B.—We do not think that his remarks carry the subject appreciably beyond its existing point.

Plate 176.

Exd
39e

RECENT IMPROVEMENTS

BY J. E. M^c^ CONN

Fig. 1.

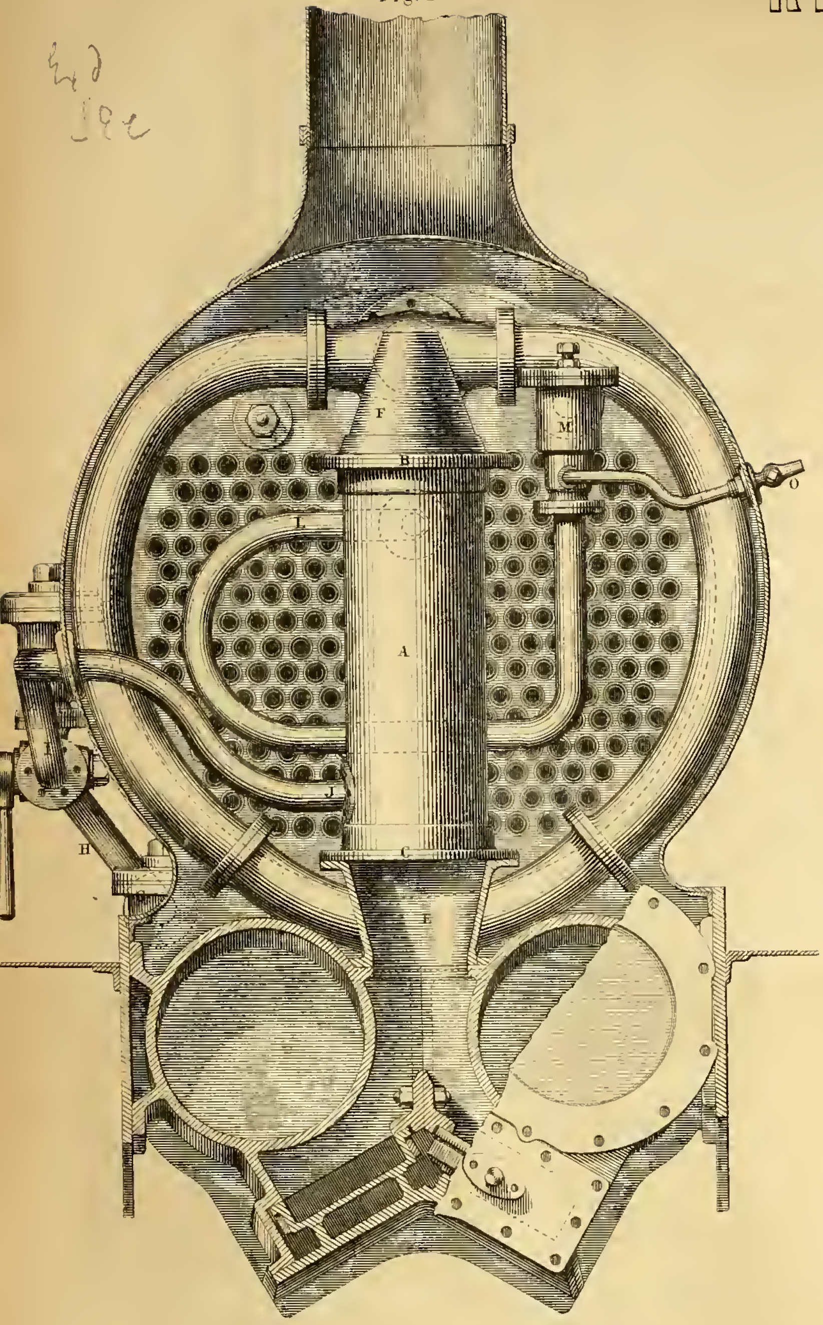


Fig. 3

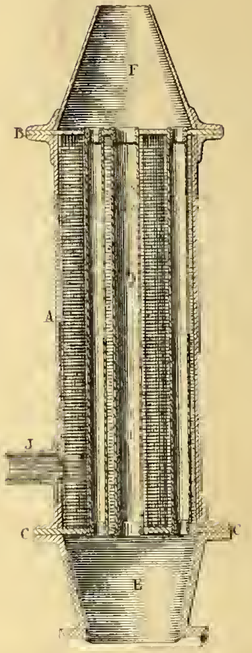


Fig. 5.

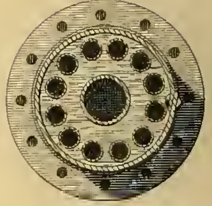


Fig. 4.

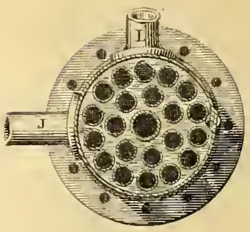


Fig. 6.

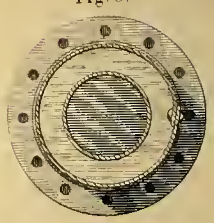


Fig. 7.

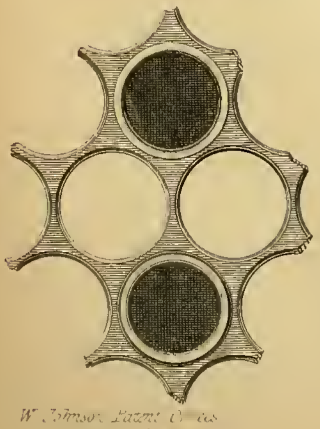
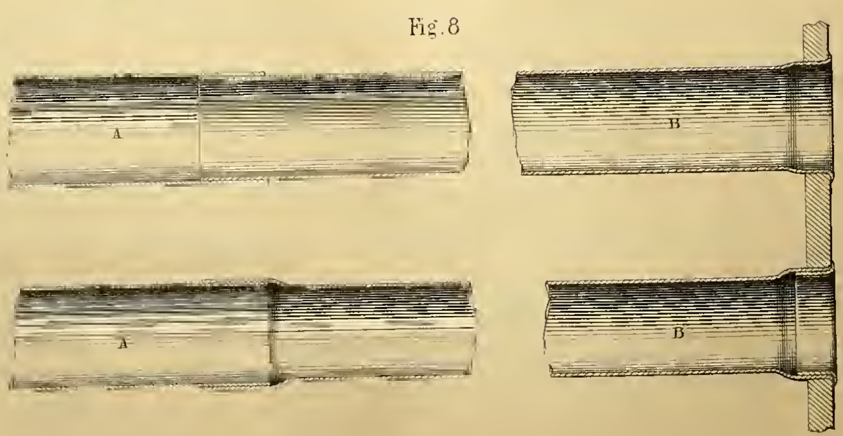
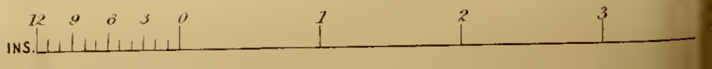


Fig. 8



W. Johnson Patent Offices
47 Lincolns Inn Fields & Glasgow



N LOCOMOTIVE MECHANISM,

LL ESQ$^{\text{R}}$ WOLVERTON.

Fig. 2.

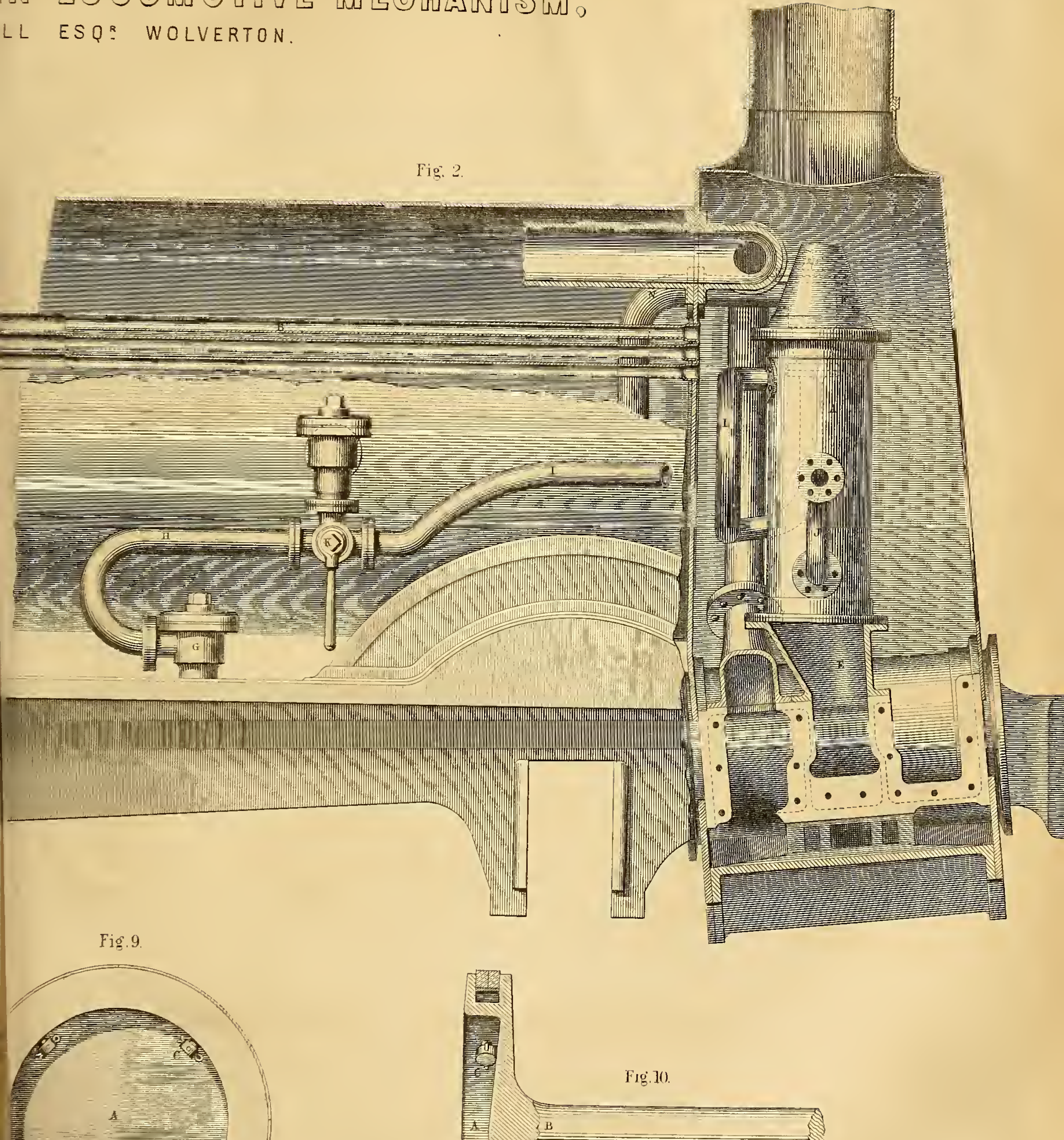


Fig. 9.

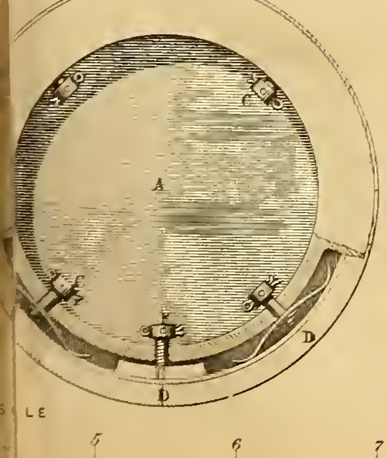
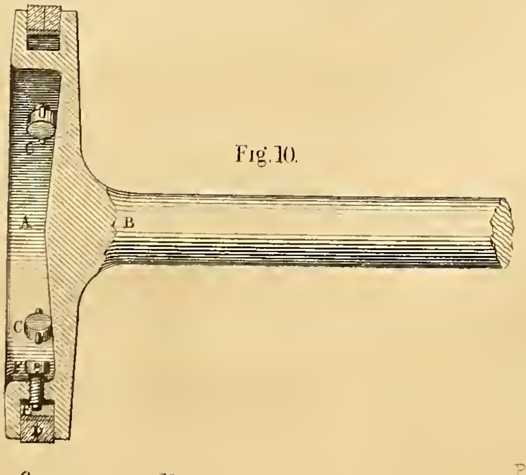


Fig. 10.



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RECENT IMPROVEMENTS IN LOCOMOTIVE MECHANISM,

BY J. E. M^c CONNELL ESQ^r WOLVERTON

Fig 1

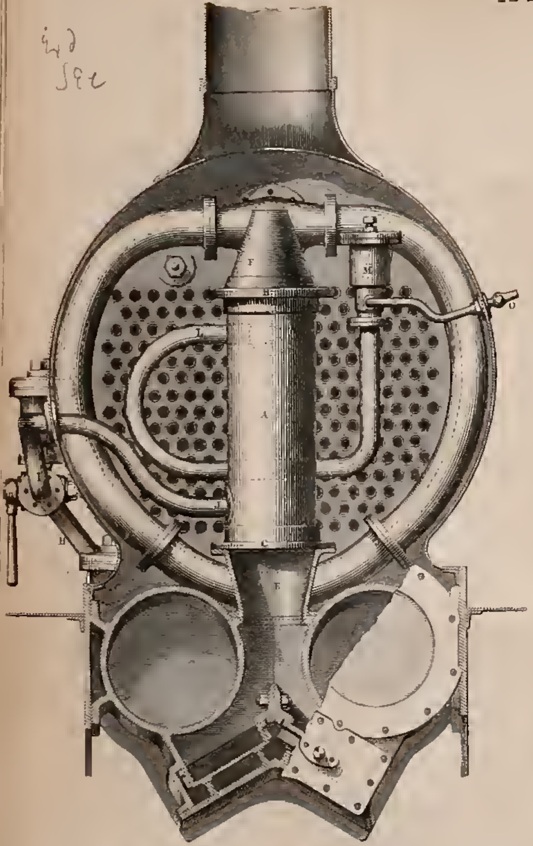


Fig 3

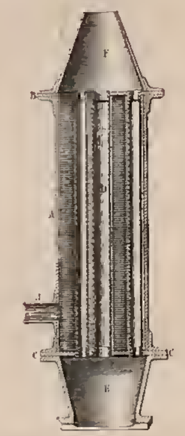


Fig 2

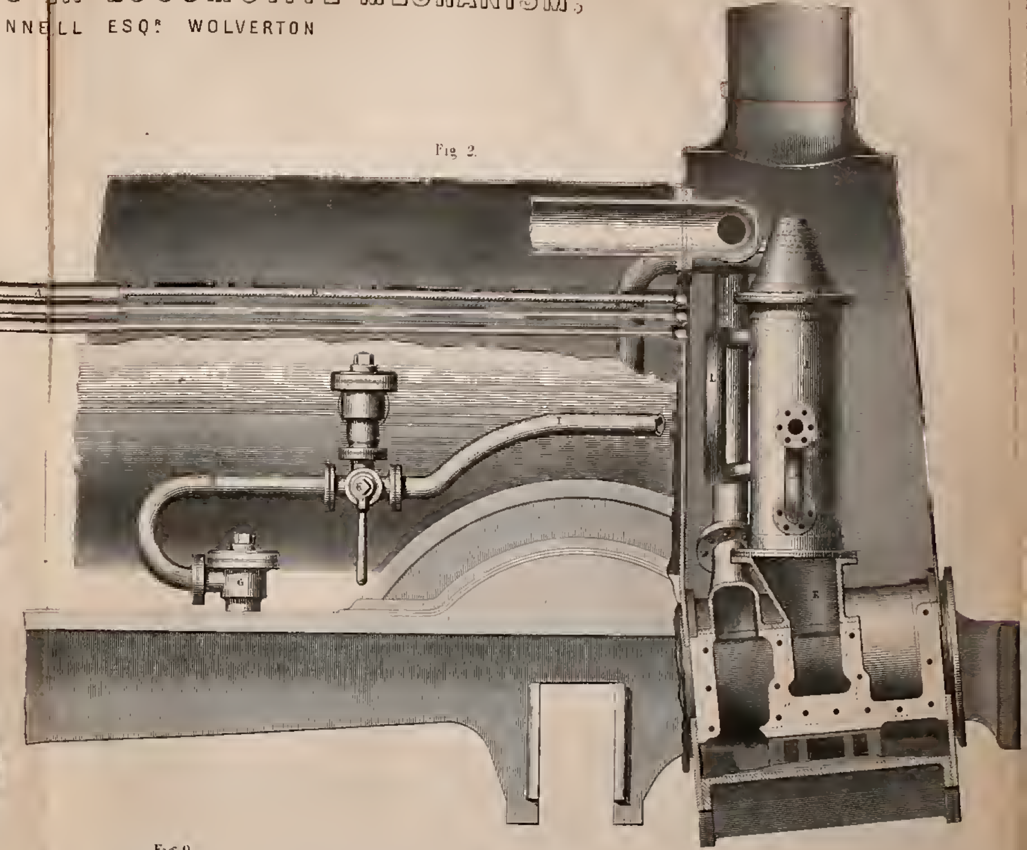


Fig.5

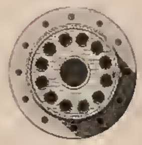


Fig.4

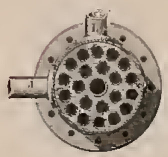


Fig 6.

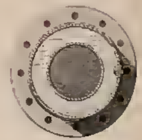


Fig.7

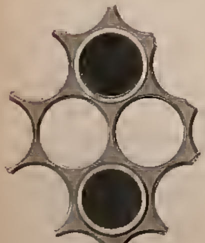


Fig 8

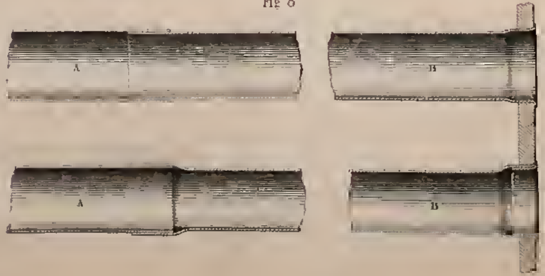


Fig 9

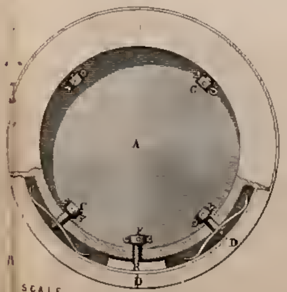
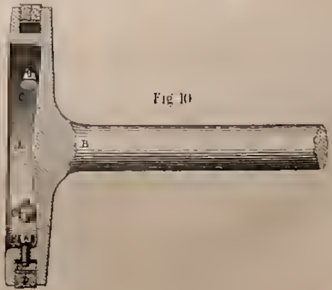


Fig 10



THE GREAT EXHIBITION AT PARIS, 1855.

(FROM OUR OWN CORRESPONDENT.)

The Great Exhibition of 1851 has now become a part of the past, and memory, as is its custom with things gone by, is beginning to invest it with the enchantment which distance lends to mental as well as to physical vision. Our seniors love to dwell upon the degeneracy of present times; but when we look around us, we are led to believe that the degeneracy they speak of is a delusion, for there is ample evidence that mankind is not standing still. On the contrary, there is proof that we are advancing every day from the unknown to the known—from knowledge to power. There are probably some amongst us who will give way to this feeling of preferring the past to the present, when they compare the two Great Exhibitions of London and Paris. It is our duty, however, to put aside all prejudices, whether personal or national, and to judge honestly, without prepossession or bias. Coming after our Exhibition, the French Exposition has disadvantages as well as advantages. The Exhibition of 1851 was a magnificent success. It was opened with great pomp; it attracted great crowds during the whole period of its existence; it excited, to the highest pitch, the feeling of national pride, and that feeling was not built, as is usually the case, upon the humiliation of other nations. On the contrary, we called aloud to them, "Come and see," and come they did to admire our proud doings, and to rejoice in our joy. Finally, it closed amidst the regret of the whole civilised world. Coming after so prosperous an undertaking, the Exposition Universelle of Paris has a difficult ordeal to pass through, in the comparison which will inevitably be drawn between itself and its predecessor. On the other hand, it derives great advantages from the experience of the past. It is much more easy to do a great feat the second time than it was the first. There is less of experiment about it; difficulties can be better foreseen and obviated; and, in short, it is less arduous to follow than to lead.

Looking, then, at what has gone before, and at what the French have done, we can have no hesitation in saying that they have accomplished something which redounds greatly to their honour. It is true that their proceedings were not accompanied by punctuality, as they ought to have been, and they thereby disappointed themselves and the world. But now that the Show is complete and open, we see the great grandeur of the result, and the vast labour by which it has been brought about.

To those who visited our own Exhibition, we would say, come and satisfy yourselves that the world is making progress; to those who did not, we can promise an immense amount of pleasure of the most instructive kind, and instruction of the pleasantest kind. Every one who compares the two Exhibitions must perceive a decided advance since 1851, in almost every branch of manufacture; and we think that the present Exhibition must be held to afford a more complete and accurate idea of the state of the industrial arts of the present day, than did our Exhibition of the state of the arts of that day. At the latter, English arts and manufactures predominated more than French arts and manufactures do at the present Exhibition, at least so far as regards all articles of a bulky nature and of difficult transport. This is owing to the facility and rapidity with which the various states of Europe can send their products direct to Paris by land. There can be no doubt that the inconveniences of a transport, partly by sea and partly by land, operated injuriously on the Exhibition of 1851.

When we survey the buildings as a whole, there is a great want of an entire impression, such as we derived from the vast palace of glass and iron which stood in Hyde Park. It is clear that those who superintended the arrangements at Paris could not have anticipated the multitude of contributions they would receive. The main building, which was originally intended to contain everything, though, in point of architecture, it remains a chief, is, in point of extent, an insignificant, part of the whole. The space demanded by exhibitors required the erection of a supplemental building, and this, neither in form nor in style, agrees with the original edifice. The main Exhibition building itself is not to be compared to that of Hyde Park. Externally, indeed, it has some points of beauty, but it is not easy to get a satisfactory view of it, on account of the trees that surround it.

The simple and unique appearance of the Hyde Park Palace excited the admiration of all. The appearance of the Palais d'Industrie is much injured by the mixture of glass, iron, and stone, by which simplicity is destroyed, and nothing gained. By employing the latter material, the architects made pretensions to a higher and more refined development of structural beauty; but we think they have failed in working out their plans. In the rows of windows along the front of the building, there is little of that excellence and superiority of design which the occasion demanded; and as for the principal entrance, it seems to us poor in the extreme, and spoiled by the disposition of the figures, which are of various sizes or scales, and give the whole an appearance of patchwork, which is increased by the want of harmony between the design of the arch and that of the doors and window in the recess. The building would make an excellent railway station; but as a Palace of Industrial Art, it is not worthy of the objects it contains. Taking the ornamentation in detail, it is chaste and elegant, and it is set off to the greatest advantage by the beautiful cream-coloured stone of which the building is composed.

There are two distinct parts in the French Exhibition, having separate buildings near each other. Firstly, there is the *Exposition des Beaux Arts*, containing a wonderful collection of more than 2000 pictures, the works of painters now living or only lately dead, as well as a great number of pieces of sculpture, engravings, &c., making altogether a grand total of 5,112 works of art. This portion of the Exhibition is contained in a separate building near the western end of the *Annexe*. Secondly, there is the *Palais d'Industrie*, divided into three parts, viz., a handsome stone building, the *Palais* proper, lately erected with the view of affording the Parisians a permanent exhibition building. This contains examples illustrative of the decorative and useful arts. Adjacent to this building is a round structure holding tapestry, Sevres china, and the regalia of France. Lastly, there is a supplemental building, called the *Annexe*, in which are placed machinery, natural products, raw materials, and the productions of chemistry. It thus appears that whilst the Palace and the round building hold articles of an ornamental nature, those appertaining to the processes of manufacture are deposited in the Annexe, and if the latter be styled the workshop, the former has the character of the show-room. This arrangement, however, is not rigidly adhered to, since we find models of machinery scattered all over the Exhibition. The Annexe and the Panorama do not pretend to any external beauty. The ends of the Annexe are slightly ornamented. The sides are chiefly of wood work, and the whole is covered in by arched iron roofing, partly glazed. The Panorama is also principally walled with wood, and roofed with iron and glass; but the roof is scarcely visible from the interior, on account of a kind of umbrella-like tent or canopy. The upper parts of the sides are also covered with hangings similar to the canopy, and the whole has a heavy and sombre effect. Indeed, the place should be called the Turkish Divan rather than a Panorama, which is certainly a name given at random. This divan is surrounded by a spacious covered court, which contains a great number of French articles. Indeed, the whole Panorama is devoted to French exhibitors.

Before going so far into the Panorama, however, we ought first to have introduced our readers into the interior of the main building. On entering, we were much disappointed with the effect of the interior, on account of its size looking much less than the idea of it formed by an inspection of the exterior. Could we look down on the top of the building, we should find the roof composed of a large semi-cylinder, cut off square at the ends, along each side of which central semi-cylinder there runs a smaller semi-cylinder, bevilled off at each end, to meet similar semi-cylinders placed transversely across the square ends of the large central semi-cylinder. Now, when we are in the central hall, we only see the space contained below the central semi-cylindrical portion of the roof, and the size of the interior is thus curtailed both in width and length. The outside semi-cylindrical portions of the roof cover the galleries, which are of course very extensive. The appearance of the large hall is, consequently, much inferior to the internal appearance of the transept and nave of the Hyde Park Palace. The hall is also injured by the flat semicircular ends of the roof. These ends are quite plain as regards the framework, but they are filled with allegories in coloured glass. At the west end we read—

> "L'Equité preside à l'accroissement des échanges."

And at the east end—

> "La France convie les nations à l'Exposition Universelle."

These two allegories are almost exactly alike, the chief difference being in the figures of Justice and France; but they have neither of them much merit either in design or execution. The ground in both pictures is filled up with a deep blue, which produces a very cold effect in the general view of the hall. The iron framework of the building is internally painted of a uniform violet-slate colour. To our eyes the colouring is altogether less light and agreeable than the colouring of the interior of the Hyde Park Palace.

The space devoted to exhibition amounts to about 1,050,000 square feet, this being about 4000 feet more than the contents of our own Exhibition. The Palace contains 500,000 square feet, the Annexe 400,000, and the Panorama and galleries 150,000. The Palace is in shape an oblong quadrangle, 930 feet by 360, with projecting portions at the corners, and in the middle of the two principal fronts. It is constructed of stone, and is roofed archwise with glass. The doors are 28 in number. The grand entrance doors are in the centre of the north front. The Annexe is nearly three-quarters of a mile in length.

We have done with the buildings, and must now turn to what they contain; but let us first pause, and consider what it is we are going to behold. Millions of visitors will look upon this magnificent collection, and doubtless it will occur to many of them, that what they see bears the impress of other millions of human beings. Count up the number of workers through whose hands each object must have passed, from him who had the mind to design its form of beauty or its complex structure, to him who imparted to it the completing stroke. Think of the trees felled in ten thousand forests, the minerals dug in ten thousand mines. Nay more, forget not that each of these workers, benefited by the experiences of numberless predecessors, and by the scientific labours of philosophers, by whom the laws of nature have been brought to light, and nature herself made more and more subservient to man. They in whose minds this train of reflection is awakened, will not look at the Exhibition as some sudden manifestation of the powers of an Aladdin's lamp. The idea of a facile production of what is before our eyes would take from it half its impressive significance, would reduce it to but a superb dream. We read in it far more than meets the eye, and feel that we make acquaintance through their works with countless numbers of our fellow-labourers scattered over this round globe. To illustrate general reflections by a particular instance, we may mention that, in passing through the building, there was placed in our hands a circular descriptive of the exhibited model of a steamer. It was there stated that this model is the result of 7000 days' work of the most skilful class of workmen. On reading this we turned again to the model with renewed interest.

It will be our duty to devote our attention more particularly to that department which contains the examples of mechanism than to any other section; but we think it will not be out of place to take a general view of the whole Exhibition before we apply ourselves to our own special division. And at starting we have two remarks to make, which are calculated to take our readers by surprise. The chief failure and the chief success of the French Exhibition, are precisely those that could have been least anticipated. It must, we think, be universally admitted that the order and good taste for which the French are remarkable, are far from being so apparent as they ought to have been. Not only is the general arrangement worse than in our Exhibition, but in the production of effects by colouring, vistas, and grand wholes, there is ground for dissatisfaction. The French themselves are evidently very proud of their labours, and, as their guests, we do not put forward our objections very prominently; but still the feeling is general, that they have failed where most was expected of them. We do not write this in a captious spirit, or with the intention of denying that great praise is due to them for their exertions. And now, as to the other point, which has taken us, as it has no doubt taken most visitors, by surprise. The machinery and mechanical departments generally are very extensive and of great excellence. They have here decidedly beaten us.

We may here state that, excluding the works of fine art, the objects are contributed by nearly 19,000 exhibitors, of whom 3,600 were British. In the Exhibition of 1851, there were 17,000 contributors, 8000 of whom were British. It is, therefore, apparent that the proportion of British exhibitors at Paris, is much less than on the former occasion—a result which, no doubt, every one anticipated. For this reason, the present Exhibition must be looked upon as the more instructive sight of the two to ourselves, as it shows us the real state of Continental art more completely. The mechanical skill of Continental nations is here more accurately shown, and the British manufacturer and artisan are furnished with a larger and wider series of objects for their study.

The largest object in the nave, or central space, of the great hall, is a lighthouse, with lenticular lantern, lit up and revolving. This is exhibited by the French Government. It struck us that this ought to have been outside the building, for in its present position it blocks up the view, and prevents the eye sweeping down the entire length of the nave. The longitudinal centre of the nave is occupied by a cast-iron fountain, designed by Liénard, and executed by Barbezat & Co. The style is simple and neat, but nothing more. A very promiscuous assemblage of objects fills the nave. Proceeding from the centre towards the east end, we have a simple marble altar-piece, by Jabouin; a very beautiful bronze and gilt vase, by Le Prince; some very rich bronze and gilt figures, bearing candelabra on a toilette table, with richly ornamented mirror; a statue in galvanic copper, by Moris & Sons, of Julien's Amalthea and Goat; the recently-found Brazilian diamond, "Star of the South," surrounded by models of some large precious stones in their rough state. This diamond appears to be the only thing from Brazil exhibited. Next we have a bronze statue of Icarus falling, with his eyes wide open, although he is just about entering the waves head foremost. A carved wood pulpit follows, rendered conspicuous by its lofty spire. Elkington and Mason have sent a fine bronze figure of Boadicea; also a beautiful marble chimney-piece, with bronze bas-reliefs and figures, and surmounted by a bronze mirror-frame. Close to this there is a bird-cage, with carved wood-framing, containing live birds, and surrounded by flowers, which are placed in carved cups, forming part of the general design. This is exhibited by Tahan of Paris, and is a very pretty object. Another bird-cage near it, of gilt wire, is of less merit. Proceeding onwards, we notice a marble altar-piece and chimney-piece by Vossy, placed back to back, neat and elegant in design; a statue of two eagles, with wings spread wide, fighting over a crocodile. This is of large size, and in plaster, being, we suppose, a model for a statue in marble or bronze. Next are two more altar-pieces, one in marble, the other in terra cotta. Then a printer's composing and distributing machine, of which there are several of different kinds, and from different countries, spread over the Exhibition. A colossal bronze statue of St. John, by Calla of Paris, follows; after which are Burch's model express steamer, with improved propeller and moveable poop; Captain Rodger's marine trophy, covered with flags of various nations, and rising to a considerable height. Amongst the things making up this trophy, and upon the same platform, are a common anchor, Rodger's improved anchor, Bloomer's improvement upon Porter's anchor, a model of Trotman's improvement upon the same; a pretty model of Penn & Sons' oscillating engines of the paddle-steamer *Sphinx*; several shipbuilders' models of ships by Scott Russell and other Thames builders; models of lighthouses, some built upon Mitchell's screw piles. Close to the marine trophy are various kinds of accoutrements for divers, and Thiebault's fine bronze statue of a horseman despatching an arrow down the throat of a serpent, which is partly coiled round the horse. The next objects are Searle & Son's canoe-like outrigger sculler-boat, 31 feet long, by 1 foot 3 inches broad; a longitudinal-sectional model of the merchantman *James Baines;* and a satinwood four-oared boat, 22 feet long, also by Searle & Son's. Following these are the models of some of the Greenwich astronomical instruments, and Secretan's (Paris) large astronomical telescope; an elegant gilt toilet table, with mirror and other accessories, by Jackson & Graham; a neat oak bookcase, with library table, by Holland & Sons; a wardrobe, with a mirror in front, by Trollope & Sons; a fine bronze spread eagle; a bronzed cast-iron statue of the eagle-slayer, by the Coalbrookdale Company; Osler's magnificent glass candelabrum; a large and beautifully pure and uniform piece of glass, from St. Gobain, 17½ feet high by 11 feet wide; Erard's splendid green-on-gold piano, which obtained the Council medal in 1851; a small bookcase, with beautifully bound missals; a bronzed cast-iron erection for the centre of a hall or a garden, with figures and neat ornamentation; a large ornamental iron gate, by Bailly; and two lenticular lighthouse lanterns. This brings us to the east end of the open part of the nave.

Advancing from the centre of the nave towards the west end, we have a dazzling gilt altar-piece; a terra cotta flower-stand, by Miesbach of Vienna, a neatly ornamented spire-like structure with figures; a large piece of plate glass from Belgium, size not marked; a beautiful porphyry pedestal and vase from Sweden; a carved oak altar-piece from Belgium; a carved oak pulpit from the Netherlands; a bronze statue by Eck and Durand of Paris, who have several others in the Exhibition, copies of well-known works, and generally well executed; a large vase in delf and porcelain, with grapes and vine leaves round the brim; another gilt altar-piece; a beautiful bookcase or cabinet in Algerian woods; an extremely beautiful vase in unglazed white porcelain; a shrine, with Virgin and Child in carved oak; a splendid piece of granite from La Mancha, in the form of a large flat fountain dish upon a slender stem or pedestal; some pretty gilt and bronzed figures by Denieres of Paris; a towering terra cotta trophy from Wagram, Austria; a very beautiful toilet table in white marble, with four mirrors, framed in sculptured white marble, and surmounted by a Cupid on a globe, by Giovanni Isola of Massa; some tables from Venice, made of a beautiful composition (?) called Bigaglia stone. Here we come to the beautiful model of the screw-steamer *Danube*, exhibited by the French company, the Messageries Impériales. The model is a fifteenth of the actual size, and is most complete in every part. It is made to separate at the middle, in order to show the steam machinery, which is actuated by clockwork. As the engines possess some points of novelty, we shall briefly describe them. They are direct-acting, and consist of two cylinders placed horizontally on one side of the screw shaft, the condensers and air-pumps being placed on the opposite side. Each steam piston actuates four piston rods, which pass across, two above and two below, the shaft to a crosshead, which slides in trunk openings in the condenser. From this crosshead a connecting rod returns to the crank on the shaft, whilst a lug upon it serves to work the air-pump piston. The valve casings are on the tops of the cylinders, and the valves are worked by an auxiliary shaft above and parallel to the main shaft, and connected to the latter by spur wheels. This auxiliary shaft works the valves by means of cranks and connecting rods, whilst it carries eccentrics for working the expansion valves. The engines are of 370 nominal horses power, and the speed of the ship in a calm is 13 knots an hour. Her length is 242 feet, her breadth 34½ feet, and the depth of her hold 20½ feet. The screw is overhung, but in front of the rudder. It has six blades fixed on a spherical boss, which is about one-sixth of the entire diameter. Her load draught is rather more than 14 feet, and the diameter of her screw is very little less than this. She has two funnels placed athwart ships. Near the *Danube* is a beautiful small model of the *Franz-Joseph*, a paddle-steamer, plying on the river Danube. Passing these objects, we have—a neat ebony clockcase, inlaid with arabesques in various metals; an astronomical telescope, by Starke of Vienna; the lighthouse, exhibited by the French Government, already alluded to; a beautiful altar-piece for a private dwelling, in minute wood mosaic, from Vienna; a poor cast-iron fountain, by Brochon of Paris, the basin and adjacent part of the floor being covered with asphaltic mosaic by Baudouin of Paris; Thomas de Colmar's calculating machine; some splendid large porcelain vases from Berlin; a trophy of stone pinnacles and other details from Cologne cathedral, at present erecting, with various photographic views and engravings, exhibiting the progress of the work at different periods since its commencement; a well-executed colossal bronze statue of Frederick William III. from Prussia, set off to great advantage upon a pedestal and raised dais, and by a species of back piece formed by two pillars, surmounted by a gilt cornice, the space being filled in with a crimson curtain. The pillars are of dark ash-coloured marble by Bonzel, from Westphalia. Near these are some bronzes by Susse Frères, Paris; a carved oak altar-piece from Prussia; an assortment of eau de Cologne bottles near a fountain, which occasionally plays richly-scented water, at which time it is beset by ladies eager to test its qualities. Then we have several bronze statues from Prussia; a partially gilt marble altar-piece of Paris manufacture; a gilt church candelabrum; a variety of zinc structures, vases, flower-stands, and other ornamental objects, painted and gilt in a Turkish style, by Diebitsch of Berlin—the material of which these things are made is quite hid by the gilding and other ornamentation. The open part of the nave is completed by a large gilt basket of artificial flowers from Saxe on one side, and on the other a large glass-case of artificial flowers, an exceedingly close imitation of nature, by Duteis of Paris. This brings us to the western end, and from our brief summary our readers will see what a miscellaneous collection of objects fills the nave. This mode of filling the nave has been a good deal criticised. The view is obstructed on all sides, and when we ascend to the galleries the general effect is spoiled by the tops of the several cases, of the size of shops, which run along each side of the central portion of the nave. They are mostly covered with white canvas, with narrow red stripes, and from their resemblance to booths, make the body of the hall appear like the scene of a large fair, especially when the place is crowded with visitors.

If we now examine what is to be found at the sides of the nave, but fronting towards it—proceeding, let us suppose, from the west end, along the south side—we have a series of erections of different kinds, some closed glass cases, some open, and some pretending to a trophy-like appearance, but all somewhat resembling shops. Of these, the first on the route we have chosen is a combined erection by Prussia and Baden, the former, of course, occupying the larger portion. Here are some very pretty chandeliers, ornamented by glass flowers, transparent green glass leaves predominating. We notice also Mannheim lace and Prussian porcelain. Proceeding onwards, we have four uncovered erections, exhibiting some fine specimens of porcelain, pottery, and glass from Austria. Immediately behind, in a species of court, are some examples of nature-printing, and a collection of musical instruments also from Austria. Next is a case of cloth from Belgium, exhibited by F. Biolley & Co.; then one of priests' robes and church ornaments, a mass of gold and silver lace and embroidery from Brussels. Liége follows with a case of small fire-arms, her staple manufacture. Here we cross the central exit on the south side, and find ourselves in the English division, in the front of which are a series of large cases from Wolverhampton, a combined one from Bradford and Halifax; Birmingham, Glasgow (Dalglish, Falconer, & Co.'s productions), London (Copeland's productions), Shropshire, Manchester, Sheffield, and one from the county of Ulster. Crossing over to the north side of the nave, we come upon French productions, which occupy the whole of this side of the floor of the building, and almost the whole of the gallery space above it. Proceeding westward along the nave, we notice a combined exhibition of musical instruments by Pleyel, Blanchet, and Erard; a typographical collection by H. Plon, printer to the Emperor; a collection of fireplaces and ornaments appertaining thereto by Huher; a trophy of arms, chiefly artillery; a case, entitled Parisian Industry, containing specimens of the thousand and one trifles that are sold at the great centre of fashion; another of Parisian furniture, ironmongers' ware by Barbedienne, upholstery by Taban, lace by Lefebre. Crossing the central entrance, we have prints, shawls, silks, &c., by Bernoville & Co. of Paris; some beautiful porcelains by H. Fouque; court robes, trains, and similar articles, by the Maison Gagelin; gilt bronzes, by Deniere; a lenticular lighthouse lantern, and models of others, by H. Lepaute; also, in the same collection, some clocks by Wagner; next, Jacquard-woven shawls by Hebert, a trophy of marine fire and other arms with artillery, exhibited by the French Navy departments; a dazzling collection of jewellery, by Froment and Meurice; a collection of articles in zinc, by the Vieille Montagne Company, from whom we find objects in various parts of the Exhibition; a collection of models of engines, locomotives, bridges, waterwheels, a large and complete model of the St. Jacques' forge, models of cranes, slotting and riveting machines, all of French manufacture. This brings us to the east end of the nave again.

Having thus given a general idea of the various productions exhibited in the central part of the building, we will dive into the extensive quarters behind and under the galleries. In some places there is a deficiency of light, and, in consequence, we found these spots without visitors, even on days when other parts of the building were crowded. Several very interesting objects and productions will thus never be seen, except by a few visitors fond of groping about and prying into obscure corners. Returning then eastward along the north or French side, we find, at the back, an extensive collection of textile manufactures of the more useful class, the showier articles of luxury being, for the most part, up stairs. There is a good collection of cloths, gloves, shoes, and such like. Towards the centre, there is a collection of bronzes, gilt metal ornaments, figures, and candelebra, which is remarkable for its extent and variety. It is composed of the productions of several Parisian ironmongers. The gilt figures and ornaments are extremely rich, and the whole gives a good idea of the recent rapid increase of this class of artistic manufacture. Proceeding onwards, we find in the background a large assortment of pottery ware—bricks, tiles, pipes, amongst which are several kinds of hollow bricks. Nearer the centre are large quantities of beautiful porcelain ware, some very superior flowers in unglazed white ware, by Vieillard of Bordeaux; an exquisite vase, in the same material, by Pony of Limoges, the design of this last comprehending cranes and plantain trees beautifully arranged. Jouhanneaud and Dubois exhibit some splendid large flagons of unglazed white porcelain, thirty inches in height; also, some very pretty vases, combining the white ware with glazed colours. M. Gille, jun., also deserves notice for his beautiful figures in dull white porcelain. Near these is a very handsome ruby-glass epergne, with gilt porcelain foot richly ornamented, which has been purchased by Louis Napoleon. This piece is by Lahoghe and Pannier of Paris. We now come near the north entrance, but, before crossing it, we notice some cases of silver plate, silver and gold services, Roman Catholic Church ornaments, crosses, candlesticks, and articles of this kind. M. Callot of Paris exhibits an extremely rich siver-gilt tea service.

On each side of the north entrance are some fine specimens of terra cotta, one a richly ornamented Saxon doorway. Passing on we have the collections exhibited by several Parisian gold and silver smiths and jewellers, all extremely rich. Grichois exhibits his new system of gold and silver ornamentation in the interior of glass plates, in some caskets, and other objects which have a very light and elegant appearance. Durand has a splendid silver tea service, and there are some more church ornaments. A little in the rear are some pretty ornaments, made out of the cactus fibre brought from Algeria. On reaching this point, we were stopped by a crowd of ladies examining some wax dolls, full baby size, richly dressed, but not very life-like. Behind we find plain glass of all kinds from different parts of France, and amongst it some very large shades; also, samples of wire-card filleting for carding engines, and an extensive collection of cordage, more particularly for marine purposes; also canvas, amongst the last of which we notice a piece 27 feet wide and 79 feet long. Turning towards the centre, we observe a mirror and picture-frame ornamented with spun-glass flowers—very pretty, but not much in advance of what we remember to have seen years ago, when this kind of work attracted more attention from its novelty. Close by is another spun-glass production—a lion, full-life size, and scarcely to be distinguished from a real stuffed skin: this is from Saumur; and in the same court are some pretty glass ornaments, of various kinds, from Clichy; also, some fine vases, of a rich deep blue, ornamented with wreathes of gilt flowers. The French photographical exhibition is close to the above, and is very extensive and exceedingly attractive. There are portraits in all styles, uncoloured and coloured, the latter, in some instances, having as much of the artist's work upon them as would produce a miniature without the aid of photography. There are also many landscapes and photographs of celebrated buildings, monuments, and statues. We were greatly pleased by some landscapes by Heilmann of Pau. This artist evidently uses quite a different process to that adopted by the generality of photographers. His colour is of a very good tint, and the minute details are exceedingly well brought out, whilst the half tints are superior to anything we have seen, throwing a beautiful softness over the whole, without sacrificing sharpness of outline. Adjoining the photographic exhibition are collections of engravings and prints of French production. Those by English artists, though forming only a small collection, seemed to us to surpass in excellence the French engravings. In the French collection are some good examples of lithography and colour-printing, Amongst the latter are Cbevreul's diagrams, showing an immense number of gradations of colours. At the back of these collections we find the flax and hemp manufactures, whilst, towards the centre, we have courts containing a great variety of objects; such as plaster casts, fruit imitated in wax and other materials; a cast of Milo's Venus in the centre; some beautiful minute medallions and figures in cream-coloured gelatine, by H. Vincent; some small figures in plaster, by Marchini and Dufailly. Proceeding onwards, we see towards the back an extensive collection of brushes of all kinds, from artists' brushes and tooth brushes down to sweeping brushes. Next are ornamentally coloured and embossed papers for bookbinders and others; some linen fabrics and a few laces at the back; printers' collections, showing type, ink, and other accessories. A court towards the centre contains productions of the Imperial Printing Establishment, a very excellent and complete collection. Near this are pictures in hair. Some of them by Lemmonier, the celebrated artist in hair, are of very large size, and around these a crowd is usually seen.

We now arrive at the north-eastern corner of the building, and at a collection of the plainer kinds of textile manufactures. Crossing the east end, we pass through exhibitions of combs, hats, perfumery, hairdressers' productions; some pretty dusting brushes made of feathers; basketwork; costumes, set off upon plaster and wax figures; tailors' ready-made articles, showing the various styles and fashions of modern costumes; and, finally, assortments of underclothing, some things being extravagantly ornamented, considering they are not intended to be seen. Along the north side of the east entrance are columns and other architectural ornaments in imitation marble, and chimney-pieces in alabaster and marble. These are French, but, on the other side of the entrance, we find ourselves amongst similar productions from Great Britain. Amongst them are,—an unmeaning allegorical alto-relievo, of large dimensions, in plaster, intended to represent the union of the French and English fleets; some examples of Stevens' pretty glass mosaics, showing their application to tables, pedestals, and pillars; Dolan's scagliola pedestals and columns; and various articles in Cornish serpentine. The space under the galleries on the south side, from the east end to near the centre, is appropriated by English productions, which have been arranged, like most of the divisions of the Exhibition, with very little attempt at classification. Entering inside the partition, which divides off the east entrance, we come upon a court of musical instruments, containing, amongst other things, Bevington's large organ and Erard's pianos. Hung high up round this court are several large carpets, amongst which we notice some from Templeton of Glasgow, who has several in different parts of the Exhibition. A set of Messrs. Salt's alpacas, of a great variety of brilliant hues, forms the upper part of the entrance partition, and below them are some cases of flax and hemp manufactures from Dundee. In the same court are some very good imitations of woods and marbles, by Moxon of London and Edinburgh. On the walls of the staircase, at this corner of the building, are some superior imitations of woods by Kershaw of London, and some neat paper-hangings by Woollams of London.

Proceeding onwards, we notice some jute carpets by Thomson of Dundee, and near them is a court containing models of bridges, docks, harbours, and other engineering works; also, a set of models of bows and sterns of men-of-war, sent, we presume, from one of our dockyards, but without any intimation of its origin; drawings of engines of the *Candia*, and various models of ships by Rennie; a set of drawings of the engines of the *America*, *Niagara*, *Europa*, and *Canada*, constructed by Robert Napier of Glasgow; and models, by the commissioners of Irish fisheries, of contrivances for allowing fish to pass up rivers, past weirs, or other obstructions, without reducing the water power applicable to manufactories. Near these we find a stand of beautiful models for yachts by Fincham of the Portsmouth dockyard; also, Dundas's wrought-iron gun, already described in these pages. Near these are Treloar's and Wildey's collections of articles made of the cocoa-nut palm fibre. The adjacent collection of Manchester cotton manufactures occupies a very large space, and will be interesting, more particularly to those who study the details of price and texture as well as appearance. In prints, we met with nothing particularly striking in design; there are some pretty printed cotton velvets by Simpson and Young, and a few printed calicoes of tasteful patterns by Daniel Lee. Towards the centre, near the last-mentioned court, is a number of cases from different manufacturers, and from different places, amongst which one of hats and caps by Blair of Glasgow is noticeable; also, one of sewing cotton by Clarke of Leicester, whose improved form of reel has been already described in this Journal. Here are some more of Templeton's carpets, comprehending a very pretty simple design, consisting of a species of diamond network, formed by crimson ribbons in loose folds on a dark ground, with sprigs of flowers in the spaces. Adjoining these is a splendid show of sewing cotton, in the form of trophies, from Carlisle of Paisley. The Sheffield court is in this locality, the case in the nave being, of course, insufficient to represent all its productions. We observe here some fine collections of saws and other tools from Spear and Jackson of the Etna Works; also, a very extensive collection from J. Dixon & Co. The linen manufactures of Ireland find a place towards the centre at this part, whilst behind is a neat bookcase and library table in oak from Fry & Son, Dublin. Furniture of English manufacture is also ranged along the wall for some distance, but this collection is not equal to what might have been sent. Towards the centre are several cases from the celebrated turkey-red dyers of Glasgow. Hereabouts is a *melange* of a thousand unrelated objects:—Sheffield cutlery, electro-plated goods; Glasgow printed muslins; some very pretty printed shawls; English pottery and porcelain, amongst which are some fine jars by Copeland; a handsome inlaid table by Gillow & Co. of Lancaster and London; fire-arms; Doulton & Co.'s earthenware pipes and still-worms and apparatus; plain glass from Hartley of Sunderland; Birmingham ware; Bradford stuffs; needles arranged on the windows of a pasteboard model of the Hyde Park Crystal Palace by Turner. Finer goods, papier maché, &c., from Birmingham, are towards the centre; whilst rougher and bulkier articles, such as kitchen ranges and utensils, are at the back. Cottam and Hallen's iron gates, with lamps, are noticeable here; also, varieties of Dr. Arnott's domestic fire-grates, and Elkington and Mason's fine show of electro-silver plated goods and bronzes. Towards the centre, near this part, is a court containing English porcelains from the houses of Wedgwood, Minton, Copeland, and others, which form a very fine collection. There is a very pretty toilette service in blue and parian, the fac-simile of one possessed by the Queen; two candelabra presented to the Queen by the Emperor of the French; busts of the Emperor and Empress, whom, by-the-by, we find in every variety of material, at every corner of the Exhibition, wax and soap even having the honour of representing their features. The English collection of porcelains, though very fine, and one that has taken our neighbours by surprise, is not equal to those of French workmanship, either in extent or richness; and we particularly noticed that figures and other articles in unglazed or dull white ware were much superior in the latter, both in the design and in the colour of the material; in the English examples of these articles, the material has the appearance of badly-coloured wax. Before leaving the porcelain, we must not omit to mention the specimens of the beautiful service used at the dinner given by the corporation of London to the French Emperor, on his recent visit.

At the east side of the south entrance, at which we now arrive, are two large church organs, one by Stoltz & Schaaf of Paris, and the other by Merklin, Schutze, & Co. of Brussels. At this part are the articles sent from the United States, very few of which are of an ornamental character. The Americans have evidently not exerted themselves, and their share of the Exhibition does not do them much credit. The most noticeable part (and this was actually manufactured in France) is a collection contributed by Morey and Goodyear, of articles made from caoutchouc, both hard and soft, comprehending an astonishing variety of applications of this useful material.

Advancing towards the west end, we encounter the contributions from Belgium, and first meet with a collection of metal street pipes, wires, nails, and similar articles. Liége sends an extensive assortment of cast-iron ornaments and fire-arms. Amongst the fire-arms are some very beautifully carved gun-stocks and richly ornamented barrels. Next we have textile goods—cloths, flannels, linens, merinoes, cottons, Brussels shawls; blankets like bearskins in roughness and thickness. There is a large piece of inlaid oakwork for a floor from Dekey of Brussels, which is very well put together; and there is a quantity of Belgian furniture, but this is of inferior quality.

We have now made the circuit of the floor of the main Exhibition building, and shall conclude this first notice by stating the prices charged for admission. These prices have been changed more than once; but at the time we write, the sum of one shilling and eightpence is paid on Fridays, twopence on Sundays, when, of course, the crowd is greatest, and tenpence on the five remaining days of the week. The behaviour of the visitors is always perfectly orderly. The proportion of rich and poor is remarkably kept on all the days. On Sundays, when it was to be expected that the lower classes alone would occupy the place, there is also a great increase in the number of rich visitors; whilst, when the admission-fee is tenpence, there is a surprisingly large number of comparatively poor people.

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RECENT IMPROVEMENTS IN LOCOMOTIVE MECHANISM.

By J. E. M'Connell, Esq., London and North-Western Railway, Wolverton.

(*Illustrated by Plate* 176.)

The sheet of details of the working machinery of railways, which we present this month in our Plate 176, illustrates the latest improvements carried out by the engineer of that greatest of lines, the London and North-Western. These new arrangements, which are supplementary to earlier contrivances by the same inventor, relate to the blast-pipe, the pistons, and the tubes of locomotives.

As far as the blast-pipe is concerned, the new modification involves the adaptation of a chamber of tubes, or alternate steam and water spaces, disposed between the steam cylinders and the escape passage to the chimney, in such manner as to afford the means of heating the tender feed-water on its way to the boiler, by the agency of the caloric of the waste or used steam, and that of the escaping gases in the smoke-box.

In the new arrangement of boiler tubes, each individual tube is made up of two lengths of different diameters or bores; the large diameter being next the fire-box, whilst the smaller section is towards the chimney. With this contrivance, it is assumed that the heated current passing off from the fire-box is partially retarded in its escape to the chimney, thus imparting its heat more effectively upon the reduced bore.

The improvement in pistons refer to a solid wrought-iron or steel piston and piston-rod, forged in one piece. This piston has either a single or double packing ring inserted into its edge, without any attached cover plate; the adjustment of the packing being effected by set screws.

Fig. 1 on our plate is a transverse vertical section through the centre of a locomotive engine smoke-box, fitted with Mr. M'Connell's feed-water heating blast-pipe. Fig. 2 is a longitudinal section of the engine corresponding; showing also the arrangement of feed-water pipes and clack-valve boxes connected therewith, as well as tho differential flue tube contrivance. Fig. 3 is a vertical, and fig. 4 a horizontal section of the blast-pipe water heater, and figs. 5 and 6 are horizontal sections of two other modifications of this heating arrangement. Fig. 7 is a face view of a portion of the smoke-box tube plate, showing the mode of attaching the flue tubes; and fig. 8 is a longitudinal section of two varieties of the differential or sectional tube lengths, as fitted into their places. Fig. 9 is a small face view of the locomotive engine piston, a part being broken away to represent the packing details; and fig. 10 is a longitudinal section of the piston with its solid rod.

In the first modification of blast-pipe, represented in figs. 1 to 4, the arrangement consists of a wrought-iron cylindrical chamber, A, secured at the top and bottom by angle-iron flange pieces to a pair of end disc plates, B C. These discs are perforated, to answer as the tube plates for the set of internal vertical tubes, D, which are the real thoroughfares for the passage of the waste steam on its escape from the working cylinders. The spent steam passes up from the central exhaust ports into the short branch pipe, E, bolted down so as to cover the exit passages of both cylinders; and the upper edge of this pipe being bolted to the lower blast-pipe tube plate, C, the waste current is directed up through all the internal tubes, D, and out at their upper ends into the upper conical chamber, F, answering as tho nozzle of the blast-pipe, where the steam escapes into the chimney in the usual manner. The tender feed-water is supplied to the body of the chamber, A, of the blast-pipe, so as to envelop the tubes, through the clack-box, G, and feed pipe, H, and thence through the continuation, I, of this pipe, into the curved branch, J, connected with the lower part of the heating chamber in the smoke-box. A three-way cock, K, is fitted on to this line of pipes, so that, when necessary, the feed water from the pumps may be turned at once into the boiler without passing along the part, I, of the pipe to the heater.

The water thus supplied to the heating chamber becomes heated to the boiling point, or nearly so, and the pump action sends it from the chamber through the upper branch, L, into the clack-box, M, inside the smoke-box. From this clack, a pipe, N, takes the heated feed water into the boiler; this portion of the supplying pipe being directed round the boiler tubes to some distance below the boiler water level. A small "pet cock," O, supplies the means of testing the working of the pumps. With this arrangement of heater, both the heat of the waste steam, and that coming from the flue tubes to the smoke-box, is most economically utilized, as all the heated air and gases from the tubes impinge against the external chamber of the water tubes.

The modifications of blast-pipe heater, represented in the sectional details, figs. 5 and 6, depart but little from the construction of that in the previous views. In fig. 5, a central tube of large bore is surrounded by a ring of smaller tubes; the large tube being riveted to the end plates by end flanges formed upon the tube. In fig. 6, the whole of the escape steam passes up a single large central tube, whilst the feed water circulates through the annular space around it.

The boiler flue tubes, figs. 7 and 8, and shown also in the large view, fig. 2, are each in two sections, A, B; the sectional length, B, next the smoke-box, being somewhat smaller in diameter than the other length. The upper tube in fig. 8 shows the junction as effected simply by the entering of the plain end of the smaller length into the larger one. In the lower tube, the end of the wider length is expanded so as to embrace the plain end of the other portion. Such differential tubes may either be both of brass or iron, or one of each metal combined. When one only is brass, the superior expansion of that metal tends to keep the joint tight. The tube holes in the smoke-box plate is made wide enough for the large tube, and the end of the small tube is therefore expanded to fit, as shown in fig. 8.

Mr. M'Connell's piston has its rod forged on solid; the body of the piston and the rod being made out of a single piece of steel or wrought-iron. The recess, A, on the under face of the piston, is produced by forging the metal on a matrix; the steam hammer having a face corresponding with this hollow, whilst the matrix is so formed as to leave a shank on the opposite side of the piston, as at B; this shank answering for welding on the main body of the piston-rod. This is one of the feats of the modern steam hammer—a tool which works the greatest of the wonders of mechanical conversion. After being thus roughly moulded to shape, the piston and rod are turned up true in the lathe; the annular wall portion being drilled to receive the adjusting set screws, C, for the packing. The circumferential groove for the packing, D, is also turned out in the lathe at the same time. The packing is set up to its work by bow springs, against which the set screws act; the latter being prevented from turning, and thus getting loose, by split pins passed through their heads, and bearing by their end against the body of the piston. The split pin holes answer also for the introduction of pins to turn the set screws when adjustment is necessary. A cast-iron block piece, E, set up by a back screw, F, is fitted behind the packing rings at the lower portion of the piston's circumference, or that portion resting on the lower side of the cylinder, for the purpose of taking off the extra strain arising from the weight of the piston acting upon the two lower adjusting springs.

This remodelling of the locomotive comes before us with many points in its favour. In particular does the blast-pipe feed-water heater deserve attentive consideration, for the common locomotive must be an enormous loser by the existing wasteful escape of the heat. Whatever heat we can detect in the smoke-box, and restore to the boiler for further work, must be direct gain in the economy of working expenses. Here then is a means of doing this effectually.

CONFIRMATION OF LETTERS PATENT.

By the Authors of the Patentee's Manual.

It sometimes happens that a patentee, who, when he applied for his letters patent, believed himself to be the first and original inventor of that for which he obtained the patent, afterwards discovers that some other person had invented or used the same invention, or part thereof, before the date of his patent, although it had not been publicly and generally used. Previous to the passing of the 5 and 6 Wm. IV., c. 83, such a patentee was in an unfortunate position, for his patent was altogether invalid. But the second section of that act enacts, that if in any suit or action it shall be proved, or specially found by the jury, that any patentee was not the first inventor of the invention patented, or of some part thereof, by reason of some other person having invented or used the same before the date of the patent, or if such patentee or his assigns shall discover that some other person had, unknown to such patentee, so invented or used the same, it shall be lawful for such patentee or his assigns to petition the Queen in Council to confirm his patent, or to grant a new patent; and the judicial committee of the Privy Council being satisfied that such patentee believed himself to be the first and original inventor, and being satisfied that such invention, or part thereof, had not been publicly and generally used before the date of the patent, may report to the Queen their opinion that the prayer of the petition ought to be complied with, whereupon the Queen may, if she think fit, grant such prayer. The provisions of this act are made applicable to the patents granted under the Patent Law Amendment Act, 1852. (See sect. 40.)

If the petitioner knows the name of the person whose previous use of the patented invention had invalidated it, the name must be mentioned in the petition; and if his name is unknown, the fact must be stated. (*Re Lamenaude's Patent*, 2 W. P. C. 164.) The act provides that any person opposing such petition is entitled to be heard before the judicial committee; and that any person, party to any former suit or action touching such letters patent, is entitled to have notice of such petition before it is presented. The committee requires some evidence of the patentee's belief, that at the time he applied for the patent he was the first inventor. (*Re Card's Patent*, 2 W. P. C. 161.)

The words of the statute are very general, but a discretion is clearly given to the judicial committee by the language of the act, and the following cases will show the principles upon which they have proceeded in their decisions:—

Previous to the Patent Law Amendment Act, 1852, it was the practice to issue separate letters patent for the three kingdoms; and it was decided by the House of Lords, in the case of *Brown* v. *Annandale*, 1 W. P. C. 433, that the public use of an invention in England rendered invalid a patent subsequently obtained for the same invention in Scotland. One Robinson, after obtaining a patent in England, obtained one for the same invention in Scotland, and then assigned the patents to one Pow, who, finding that, according to the decision of *Brown* v. *Annandale*, the latter patent was invalid, he petitioned the Privy Council for a confirmation. It was held, however, that the case did not fall within the terms of the act, since the petitioner could not allege that "some other person" had used the same invention before the date of the Scotch patent, the user in question having been the patentee's or his assignee's. (*Re Pow's Patent*, 2 W. P. C. 5.)

Baron Heurteloup obtained a patent in 1834, for certain improvements in fire-arms. He subsequently discovered that part of his invention had been embraced by a patent granted in France in 1821, and that there existed a printed book in the British Museum containing a description of the French invention. The petitioner's affidavit in support of his petition to the Privy Council stated, that he believed himself to be, at the time of the grant, the true and first inventor of the patented improvements; and further, that he believed the French invention had never been brought into use in France or elsewhere, and that it was not known in England, otherwise than by the introduction of books printed in France, containing a description of the invention. Notice of the day of hearing had been sent through the Post-office, addressed to the French patentee. Under these circumstances, their Lordships reported that the case was a proper one for confirmation. (*Re Heurteloup's Patent*, 1 W. P. C. 553.)

There are other cases which show that the Privy Council will not grant a confirmation where the previous user of the invention, which is alleged to invalidate a patent, and to call for the aid of the statute, continues up to the date of the patent. In order to afford ground for the interposition of the Crown, acting on the recommendation of the Privy Council, it must be shown that the previous user was not only not general, but that it had ceased, and was non-existent at the date of the patent, in which case a confirmation does injury to no one. On an application to confirm *Card's Patent*, for improvements in the manufacture of candle wicks (2 W. P. C. 161), it appeared that another candlemaker had adopted the same method of making wicks before the date of the patent, and that he and his brother had practised it in different parts of the same country. It appeared, moreover, that one of them, and the assignees of the other, had continued to make wicks in that way up to the time of the hearing of the petition. The method had been mentioned by them to other people, and there was ground for supposing that another candlemaker had adopted it. The judicial committee considered that this was not such a case as the Legislature had in contemplation when they passed the act, and they refused the application.

Lamenaude obtained a patent on the 18th of July, 1848, for an invention of a method of fixing letters upon glass without wire or iron. It turned out, that somewhere between the 12th and 15th of the same month of July, some letters had been fixed upon glass by this very method by another person. This was sufficient to vitiate the patent, and an application was made to the Privy Council for a confirmation. It was argued that, although the invention had been publicly used, it had not been generally used previous to the date of the patent, and it was proved that the person who had so used it was a consenting party to the application; but it was held that the statute did not apply to such a case as this, where the invention had already got into use, and was actually in use at the date of the patent. (*Re Lamenaude's Patent*, 2 W. P. C. 164.)

The act was held not to apply to a case in which it was proved, that two patents had been previously procured for substantially the same invention as that covered by the patent which it was sought to confirm, although the previous patents had expired. (*Re Westrupp and Gibbins' Patent*, W. P. C. 554.)

Application was made for the confirmation of a patent granted in 1838 to Mr. Porter, for an improvement in the construction of anchors. It appeared that, after obtaining the patent, Mr. Porter had called on several anchorsmiths in various parts of the country, for the purpose of introducing his invention to their notice, and that, when he called upon Messrs. Logan of Liverpool, they directed his attention to an anchor which they had invented in 1826. The construction of their anchor was similar to that of Porter's, and they had sold a few of that make to various shipowners. Notwithstanding this, Porter continued to work his patent, and when it was about to expire, he applied for and obtained an extension for six years. An alleged infringement having taken place, an action was brought by Porter's assignee, and on the trial the facts as to Logan's anchor came out. Porter's assignee then applied to the Privy Council for a confirmation of the extended patent; but it was held that, as the evidence showed not only that Porter was not the original inventor, but that he was aware of the fact at the time he applied for an extension, this was not a proper case for the Crown to grant a confirmation, and the application was refused. "It is not easy," said Mr. Pemberton Leigh, on giving judgment, "to define the exact meaning of the expression, 'publicly and generally used' in the act of Parliament. Their Lordships would not consider the use of the invention on board a single ship, however public, or for whatever length of time, as a general user. They were satisfied that the invention had not been publicly used at the date of the original letters patent. Although Porter believed himself to have been the original inventor at the time when the original patent was taken out, it was clear that he could not think so at the time of the extension. Seeing that he was not the original inventor, the patent ought never to have been granted, and the prayer for extension should not have been listened to." (*Porter's Patent*, *Re Honiball*, 2 W. P. C. 201.)

HELIN'S PROCESS FOR MAKING PAPER FROM STRAW.

The increasing scarcity of materials for making a cheap and serviceable paper, has been often brought to the attention of our readers; and other portions of the public press have not been backward in stimulating the energies of the inventive and mercantile classes to increase our supplies, or cheapen the manufacture. A thousand denizens of the vegetable kingdom can, under appropriate treatment, be made to assume the form of paper. We are continually hearing of some enterprising individual having converted a very unlikely material into a usable paper. But when we inquire into the particulars of the manufacture, we soon find that the cost exceeds the value of the product, and that, in place of having a cheaper article, the paper thus produced could not be sold at so low a price as that previously in the market. Again, we are frequently receiving intelligence of the vast quantity of raw material which our colonies can supply; and upon this subject we may refer to Dr. Royle's book, noticed in another part of this month's Journal. We make no doubt that such representations are perfectly correct; but against the abundance of supply has to be set either the expense of getting rid of extraneous matter, in a country where there is no machinery, or the expense of a long carriage by land and sea of a very bulky article. In either case the cost will not allow the paper to be brought into competition with that now manufactured.

One of the materials which earliest suggest themselves as suitable for conversion into paper, is the straw of grain-bearing plants. An abundant supply of this material can be obtained at a cheap rate. There is a difficulty, however, in the manufacture, which one might easily overlook until the experiment is made. Straw contains a good deal of silica, principally in its exterior coating, and it is necessary to get rid of this before it can be made into paper. Now, the cost of the process is considerable, and has been hitherto found so great as to render the manufacture unremunerative. The principal object of M. Helin's patented process, to which we will now draw the reader's attention, is to reduce the expense of the desilicatization of the straw, and thus to add, in a very important degree, to the supply of our paper-yielding materials. M. Helin resides at Brussels, and he informs us that the paper made from pulp treated by his method, is much superior to the average quality of paper used for newspapers in Belgium. The process may be applied also to the formation of a pulp from jute, cotton, and other materials.

M. Helin's invention relates to a peculiar treatment of the straw of grain-bearing plants, for producing a pulp suitable for the manufacture of paper at an economical rate. For this purpose it is preferred to employ the straw of rye and wheat, but the same mode of treatment is equally applicable to various other vegetable substances, such as jute, flax, and hemp. The straw is first steeped entire for 60 hours, which time may be exceeded without inconvenience, in spring, rain, or river water, of a temperature of from 55° to 85° Fahrenheit, the temperature being varied according to the season of the year. After some hours, the water becomes gradually warm and discoloured, and an active fermentation takes place. After 60 hours the liquid is suffered to run off, and the straw must be washed with a plentiful supply of water, in order to remove therefrom all the soluble colouring matter. The straw is then drained, and while still damp is subjected to the action of millstones, rolling on a plane surface, or passed between a pair of rollers, in order to flatten the straw. It is then forced between other rollers furnished with cutters, or other suitable apparatus, whereby the straw may be formed into filaments or fibres, as long and continuous as possible. In this state, that is, when reduced to long and continuous filaments, the straw is to be exposed to the air and sun, for the purpose of drying it, after which process the straw will have assumed a pale yellow colour. In cases where time is no object, it is preferred to steep the straw several times, and again expose it to the air and light. It will be found convenient, in such cases, to steep the straw at night, and expose it to the air during the day, to obtain the full benefit of the air and light. The first described process of maceration is, however, the most important. By subjecting the straw to the action of water, and subsequently exposing it to the air and light, it becomes bleached to a certain extent; but by means of the processes described below, it is completely divested of all colouring matter, and is rendered perfectly white.

After having been submitted to the processes referred to, the straw is steeped for one or more days, according as it is in a more or less filamentous state, in one or more of the preparations afterwards described, the filaments being first treated either with the alkaline solutions, or by the solutions of hypochloride of potash or soda; and sometimes, for a longer or shorter period, with the preparations of hypochloride of lime, until the straw has acquired the requisite degree of whiteness. The filamentous straw, after it has been submitted to the processes first described, and has been steeped in the alkaline solutions of soda or potash, which take up a great portion of its yellow colouring matter, assumes a darker tint, notwithstanding its being washed in clean water. This darker tint disappears, however, on the straw being exposed to the open air and light; and the process, if renewed, causes the straw to become more and more white. By these processes the straw becomes reduced to beautiful filaments, which may readily be converted into pulp; and from their solidity and strength, the filaments might even be employed in the manufacture of yarns or fabrics similar to cotton and hemp. Jute and many plants of Linnæus' order, Triandria, in which are comprised the various grasses, and many plants of the orders Tetrandria, Pentandria, Hexandria, and Diœcia, when treated by the processes hereinbefore set forth, lose their colouring principles, and become of a permanently bright white. Hemp and flax may also be thus treated, and employed in the manufacture of paper.

The solutions or preparations above referred to, consist, first, of a solution of 8 lbs. of carbonate of soda or of potash, in 20 gallons of water; second, a solution of 6 lbs. of bicarbonate of soda or potash, in 20 gallons of water; third, a solution of 4 lbs. of caustic potash or soda, in 20 gallons of water; fourth, a solution of 10 lbs. of hypochlorate of potash or of soda, in 20 gallons of water; fifth, a solution of 1½ lb. of hypochlorite of lime, or bleaching powder, in 20 gallons of water, to which may be added, in addition, if necessary, 1½ lb. of bleaching powder; sixth, a solution of 6 lbs. of bleaching powder, or hypochloride of lime, in 20 gallons of water; seventh, a solution of 6 lbs. of bleaching powder, and 2 lbs. carbonate of soda or potash, in 20 gallons of water. After the maceration in water, the subsequent treatment of the straw, by any of the before-mentioned processes, may be thus enumerated:—1st, By alkaline solutions. 2d, By solutions of hypochlorides of soda or of potash. 3d, By the employment of the hypochlorides of lime, potash, or soda, as described in processes 6 and 7. When the alkaline liquids and the hypochlorides, contained in the preparations 1, 2, 3, 4, and 5, are too much charged with colouring matter, by reason of the repeated immersions of the straw, they are filtered through a layer of animal charcoal, reduced to a granulated or powdered state, for the purpose of obtaining a partial or total discharge of the colouring matter therefrom. The hypochlorides of soda and potash decompose after they have been long in use, but they may be renewed from time to time by chlorine gas, or by a solution of chloride of lime. The straw or vegetable filaments are well washed with water, after they have been perfectly bleached by the above processes, or some of them, and may then be made into pulp in the ordinary manner, for the fabrication of paper. It is evident that hydrochloric or sulphuric acids may, if deemed necessary, be used in connection with the above bleaching materials, as is now well understood and generally adopted in the bleaching of pulp in the manufacture of paper.

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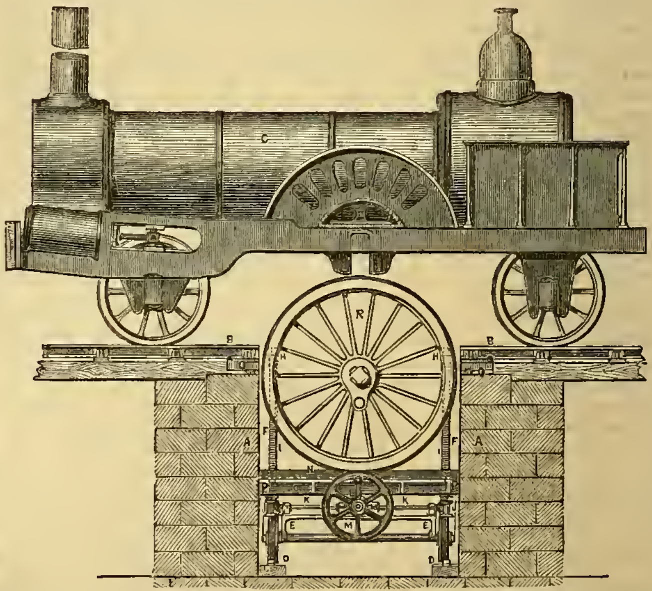
RECENT PATENTS.

REMOVING AND REPLACING THE WHEELS AND AXLES OF LOCOMOTIVES.

EDWARD STRONG, *Carstairs, Glasgow.*—*Patent dated Dec.* 15, 1854.

Mr. Strong's invention relates to a very complete mechanical contrivance for facilitating the operations of the locomotive engineer in his periodical examinations, removal and replacing of the wheels, axles, and bearings of locomotive engines, and the general rolling stock of railways. By this apparatus, the wheels and axles are taken away from beneath the engine down a pit beneath it, the engine itself being immoveable, no tilting or shift of any kind being necessary.

Our engraving represents a side elevation of a locomotive engine, as having its driving wheels and axle in the act of being removed, the removing apparatus being shown, in end elevation, in the excavation beneath. An excavation, A, is made immediately under the line of rails, B, upon which the locomotive, C, rests during the operation of removing and replacing any of its wheels and axles. A pair of rails, D, are laid along the bottom of the excavation, A, in a direction at right angles to that of the rails, B, above; and a small four-wheeled carriage, or frame, E, set upon these rails, serves to carry the apparatus for lowering or raising the locomotive wheels and axles, and to transport these from under the locomotive. The lowering and raising apparatus consists of four vertical screw spindles, F, set in footstep bearings in the carriage, E, and arranged to work through screwed eyes in a frame, G, so as, by their rotation, to cause the descent or ascent of this frame. The upper ends of the screw spindles, F, are stayed by means of cross bars, H, the four spindles being linked together in pairs, whilst the bars, H, are connected to the frame, E, below, by diagonal links, I, passing down inside the frame, G. The spindles, F, have bevil wheels, J, fixed upon them, near their lower ends; and these bevil wheels are in gear with bevil wheels on four short horizontal spindles, K, carried in bearings in the frame, E. The spindles, K, have each bevil wheels fast on their inner ends, and in gear with bevil wheels on a central longitudinal spindle, L, carried in bearings in the frame, E, and having a hand-wheel, M, on one of its overhanging ends. Thus, by turning the hand-wheel, M, a uniform rotatory motion is given to all the four screw spindles, F; and these are thereby made to raise or lower the frame, G. Upon this frame are fixed



two bars, or rails, N, which are so situated as, when raised to the level of the rails, B, above, to coincide with them, and fill up the space or break occurring in them at the excavation. When the apparatus is to be used for removing the two driving wheels, for example, of a locomotive, together with their axle, the frame, G, is raised by suitably turning the screw spindle, F, so as to bring the rails, N, to the level of the rails, B, above. The frame, G, is then steadied or held in this position by means of bolts, O, which are made to slide out from sockets in the sides of the excavation, and to project beneath the frame, G, at P. The locomotive, C, is then run over the excavation, to bring it into the position in which it is represented in the drawings. The wheels, R, are then disconnected from the engine framing, and the bolts, O, being drawn in, the frame, G, is made to descend to the position in which it is represented in fig. 1—that is to say, until it is clear of the framing of the locomotive, C; after which the carriage, E, is run along its carrying rails, D, away from under the locomotive, so as to come beneath another line of rails, for example; and the screw spindles being again put in motion, the frame, G, is raised, lifting up the wheels out of the excavation, as at S, in fig. 3, so that they can be at once removed or rolled away.

In replacing a pair of wheels upon a locomotive, the reverse of the hereinbefore described operation is performed. The wheels are placed upon the rails, N, of the frame, G; and this frame is made to descend, until the wheels are sufficiently low to get under the framing of the locomotive. The carriage, E, is then traversed, so as to bring the wheels under the locomotive, and they are then elevated into position by making the screw spindles, F, act on the frame, G, so as to raise it. The transverse pit, or excavation, is of course only necessary in situations where it is intended to convey the wheels and axles clear away from the line on which the locomotive engine stands. In cases where the invention is merely used for facilitating the examination of the axles and brasses, the removal and separation of the parts being for a short distance only, the power of vertical ascent and descent only is required; and therefore a common pit or recess, beneath the line of the main rails, is all that is required. Of course, various mechanical contrivances may be adopted for raising and lowering the frame upon which the wheels and axle are supported, whilst being removed from or replaced in the locomotive, or other rolling stock. Thus, for example, this may be effected by means of a rack and pinion movement, which may be applied in various ways.

This invention may be conveniently carried out in large locomotive workshops, where several lines of rails are arranged parallel to each other, by carrying the transverse excavation under the whole of the lines of rails, or under any number of them, so that the apparatus may be brought into use at any particular line of rails at which it may be more convenient to place the locomotive. The several lines of rails may be rendered continuous, when the raising and lowering apparatus is not in use, by means of filling up rails laid across the excavation, and suitably supported at the sides thereof.

FORCED COMBUSTION IN FURNACES.

Alexander Chaplin, *Glasgow.—Patent dated April* 10, 1855.

The fruits of the modern factory system develop themselves in the eyes of every amateur observer, under the form of an exuberant crop of lofty brick erections, unceasingly belching forth dark, slow-rolling volumes of smoke, and setting an unmistakeable mark of wretchedness on every spot within their reach. Mr. Chaplin is one of those who think with us, that this reign of vast chimneys may one day be brought to an end. He argues that the earth was not intended to grow such hideous excrescences, and backs his position by devising a fair and practical means of enabling the proprietor of mechanical power, to spin his cotton and smelt his ironstone without them. His specific is the forcing or compelling combustion in the furnace, instead of coaxing it by the draught of an elevated chimney-stalk. No one can examine the draught action of a tall chimney without seeing at once, that the stronger the current, the more rapidly will the combustible gases be carried off, leaving no chance of igniting a large portion of the really valuable products sent forth from the fire-grate. We have thus at present not only the directly disagreeable objection of a smoky atmosphere, but the ugly feature touching the breeches pocket, of an unseen but sorely felt loss of the chemical equivalent of mechanical force.

In Mr. Chaplin's system, the draught chimney is virtually abolished. Instead of hurrying away the gaseous products of his fuel, directly that they are developed by the heat of combustion, and giving no time for acting upon the flue surface of the boiler, he resolutely restrains and hinders the entire gaseous current in its attempt to escape, causing whatever comes from the furnace to be kept back and commingled with the flame and incandescent fuel therein.

Our engraving, fig. 1, roughly exemplifies this plan of working, as put in force upon an ordinary cylindrical steam-boiler furnace for stationary use. In this sketch, which is a longitudinal section of the furnace and its appurtenances, the ashpit, A, is completely closed up below, close fitting doors, B, being fitted to the front of the pit, hermetically sealing up the recess from contact with the atmosphere. An air pipe, C, conducted from a blast fan, is led into the ashpit from beneath, its open inner end being directed upwards, so as to pass the air current in between the furnace bars, to mingle with the burning fuel above. The furnace flue is of the "flash" kind, and the bridges are so alternated as to cause the current, whatever there may be of it, to have a somewhat tortuous route along the boiler's bottom. When it reaches the extreme end of the boiler, it is barred from farther progress by a thick damper plate, D, guarding the outlet to the chimney. This damper is adjustable by a horizontal sliding action; it is at least three inches thick, and is perforated with holes to the extent of about one-seventh of its area; thus a continuous ascending air current goes on through the fire, similar to that produced by the draught of the ordinary chimney-stalk, with the essential difference, however, that there is a complete admixture and ignition of all that is combustible in the fuel gases; and the damper plate being adjusted to suit the actual requirements of the case, prevents the extravagant escape of the heat, leaving it to be absorbed by the boiler.

Fig. 1.

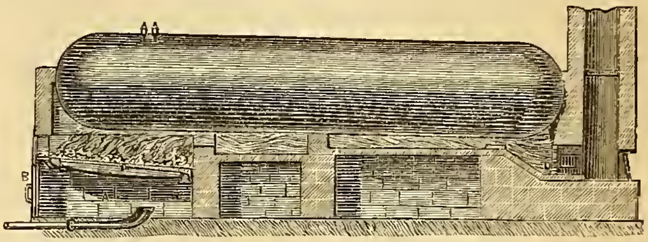
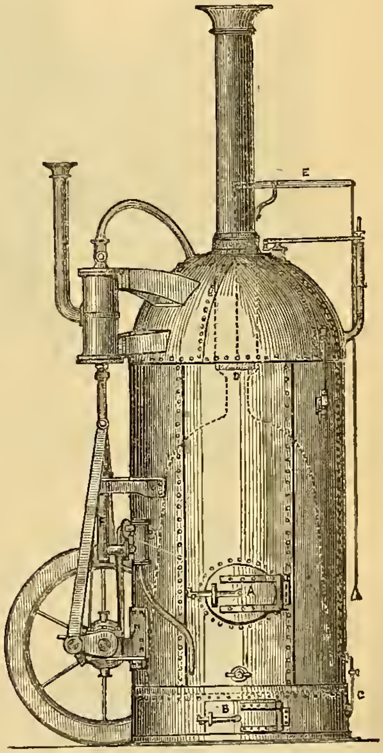


Fig. 2.



This system may be adapted to existing boilers of all kinds, by adding the simple details of the damper, ashpit doors, and the air pressure pipe. In situations where there is no engine for driving the blast fan, the air supply may be derived from the steam jet, steam being led from the boiler, so as to carry in air in the manner lately introduced for other purposes. The points of advantage claimed for this mode of working furnaces are,—a saving of fuel, equal to from 15 to 30 per cent., by compelling the caloric to do the work expected from it; the absence of smoke, as even careless firing cannot cause the evolution of thick smoke; the reduction in the size of the chimney; and the use of cheap fuel, anything in the shape of coal being combustible under the circumstances which we have indicated.

Fig. 2 represents the invention as adapted to a vertical high pressure boiler, the steam jet being employed as the vehicle for forcing combustion in the furnace. This drawing has been made from the engine and boiler actually at work in the patentee's establishment in Glasgow. A is the firing door of the furnace, admitting no air above the burning fuel; there being no connection with the external atmosphere, except for the short periods during which fuel is being supplied. The ashpit beneath is sealed up by the bottom door, B, used for the removal of the ashes.

Steam is brought down from the top of the boiler by the small pipe, C, running down inside the shell, as dotted in, a stopcock being provided at the lower end for the adjustment of the slight steam current which passes through the ashpit case, carrying with it a large volume of air through a wide encircling pipe. The retarding damper, D, is at the top of the inner fire-box throat, being governed by a lever, E, from which a chain passes down the side of the boiler to the engineman's hand. The parallel dotted lines above the damper, indicate the flue passage leading from the damper to the chimney.

The engine is attached by brackets to the side of the boiler, the guide for the projecting end of the piston-rod being obtained from the feed-pump, F, into which the piston-rod end enters to work as a plunger. The whole forms a very compact, simple, and useful engine, independently of the special arrangements affecting the combustion in the furnace.

COMPOUND STOP AND THROTTLE VALVES.

W. Binns, *London, and* James Houghton, *Oldham. — Patent dated May* 26, 1855.

For the development of this invention, the mechanical drawing-master of the government department of practical art has worked conjointly with a practical engineer of Lancashire, and the combined suggestions have resulted in some useful valvular contrivances.

Fig. 1 of our engravings represents a sectional view of Messrs. Binns and Houghton's compound stop and throttle valve; and fig. 2 is a transverse section of the valve behind the seat. The valve chest is of cruciform shape, the two short transverse branches being in correspondence with the main steam pipe. The two end or longitudinal sections, A B, of the chest, are in connection with the transverse branches respectively. They answer for admitting the two valves and their seating, in putting the parts together, and they are closed by end stuffing-box covers. The valve seating, which is of the "ventilator" kind, is at C. It is faced and ground true on both sides. The stop valve is at D, being governed by a screwed spindle passed through the end cover stuffing-box of the section, A, and fitted with the adjusting hand-wheel, E; so that, on turning this hand-wheel, the stuffing-box gland answers as the nut for traversing the spindle, and setting the valve on or off its seat. Thus the section, A, of the valve chamber answers for the stop-valve action alone, the opposite section, B, being for the throttle valve, F. This valve is fitted to the opposite face of the seat, C, being carried on the inner end of the spindle, G, entered through the stuffing-box on that side, and having attached to it an external lever, H, for connection with the governor in the usual way. The extreme inner end of this throttle-valve spindle turns in a central hole in the intermediate valve seat as a centre. The outer end of the spindle works upon an adjustable pivot centre, in an external bridle-piece fast to the valve chest. The arrows show the direction of the steam current through the valve chest. The pressure upon the inner face of the throttle valve is resisted by the external dead centre; so that, by setting this up properly, the working friction may be diminished to a mere nothing. The advantages gained by the adoption of this compound valve are, the greater facility in starting and stopping the engine, by reason of the stop and throttle valves being so close together, and the general superiority of the valvular arrangement as a regulating power.

Fig. 1.

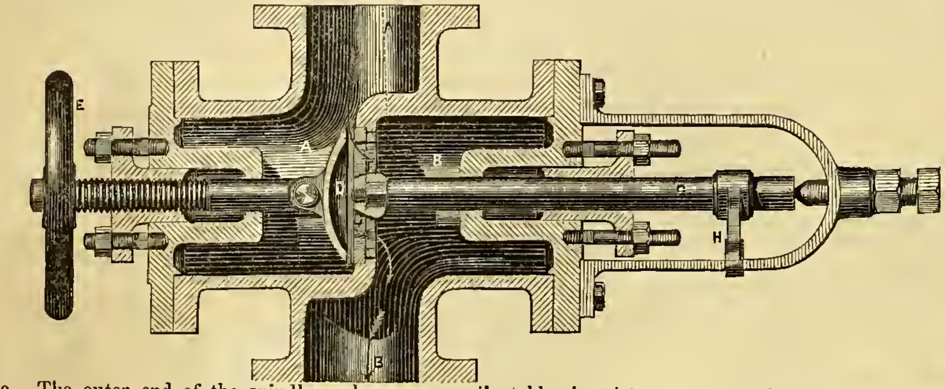


Fig 2.

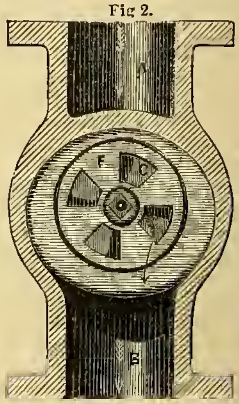


Fig. 3.

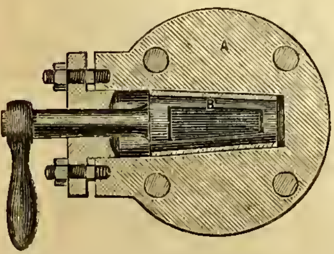


Fig. 3 is a sectional view of Messrs. Binns and Houghton's new form of stopcock. In this view, A is a cast-iron blank flange, of a diameter corresponding with that of the pipe to which the valve is attached. This is bolted into the line of pipe by four bolt holes near the edge. A conical hole is bored down from one edge of the flange, A, so as to be at right angles with the lateral passage through the flange for the steam or water. This conical hole is bushed with a thin brass lining piece, which is ground internally to receive the valve plug, B. The spindle of this plug is passed through a stuffing-box at one side of the flange, A, being fitted with an adjusting lever handle. By turning the handle a quarter round, the lateral hole at B, in the plug, may either be brought into line with the lateral passage through the flange, to admit of the fluid flow, or set at right angles thereto, to close the valve.

CLAY BALL DRAINING.

Captain Norton, *Dublin.—Patent dated January* 11, 1855.

Captain Norton's devotion to the science of gunnery has yet left him some time to work at other branches of improvement. His present subject concerns the operations of the farmer in the important point of draining—hard spherical balls of clay being used as the draining medium. The clay of which the balls are made, is moulded by any convenient machinery, preserving the spherical form as accurately as possible. When dried, the balls are burned to a crystalline hardness, so that when deposited in the earth they will literally endure for ages. The size or diameter of these drainage balls must be varied to suit different circumstances; but a diameter of four or five inches is the average size preferred. Such balls, when laid in drain cuts in the soil, allow the surface water to descend and pass freely through or between them, and thus get clear off the land. Spherical stones would obviously perform just as effectively as the clay balls, but the latter are preferred, for the reason that in them absolute sphericity may be secured, whilst that would be impossible even with the use of the smoothest and roundest pebbles.

Fig. 1 is a longitudinal section of a portion of a field drain of this kind, and fig. 2 is a corresponding transverse section. A rectangular cut, A, is first made in the soil, B, in any convenient manner; and when a sufficient depth has been attained, the bottom of the recess is levelled off, and made hard and substantial as a base, by laying thereon lengths of slate or other conveniently and economically available material, C, filling up the entire width of the drain cut. In this condition of the work, a bottom row or layer of spherical clay balls, D, is laid into the drain, the two diameters of each transverse pair of balls being in the same transverse line of the drain as indicated in fig. 2. This drain is supposed to be eight inches in width, so that two clay balls, each four inches in diameter, suffice to fill it. When the entire base of the drain is thus filled in, a second layer of balls, E, is set above the

Fig. 1.

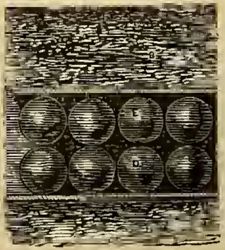
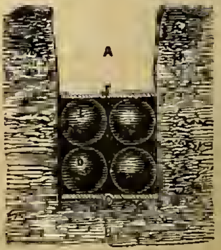


Fig. 2.



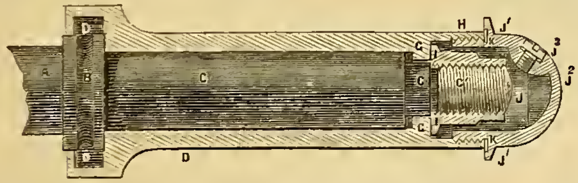
lower layer, the diametrical lines of the balls coinciding vertically in the manner shown in fig. 2. This completes the draining medium, and the two layers of balls are then covered over with a cover layer of slates, F, to carry the earth thrown in above in levelling and making fair the field. It is preferred that the sod side of the superincumbent earth should be downwards. This relation of the balls gives a clear thoroughfare for the drainage water through the central space enclosed by each set of four balls, as in fig. 2; at the same time there are three half passages or thoroughfares for the water at the bottom and top of the ball layer, and one half passage on each side. Hence there is always a free passage for the water to drain down, and percolate through the enclosed spaces due to the contour of the balls, getting clear away along the slate base of the drain channel to the main outfall.

Captain Norton illustrates his contrivance under several forms, the balls being variously disposed in the drain cuts, whilst, in one instance, three several sizes of balls are used in combination. Drains made in this way, always present a full free passage for the descent of the water, as the spaces between the balls can never be diminished except by the introduction of other solid bodies; and the roundness of the balls is itself a point in favour of the avoidance of such foreign deposits; like the links of a chain, the balls will always conform to the actual surface of the ground, and no sinking can effect any serious dislocation, or prevent the drainage from being full and free.

CARRIAGE AXLE BOXES.

J. H. Johnson, *London and Glasgow.—Patent dated Oct.* 30, 1854.

This ingenious arrangement of carriage axle box, is the invention of M. Laurent of Honecourt, France. The engraving represents it in longitudinal section, the axle itself being represented as broken away at A. The part just within the axle box has formed upon it a grooved collar, B, terminating the inner portion of the journal, C, bored to fit the box, D. A collar, G, is cast upon the interior of the axle box, and through this collar is passed the reduced end of the journal, which terminates in a screwed port, C′, on which is a nut, I, bearing against the collar. The part, H, of the box is of slightly larger internal diameter than the rest of the box to admit the nut, and it is screwed internally to receive the solid ended oil reservoir, J. This end cap has a wide flange, J^1, grooved annularly, to hold a leather washer for making a tight joint when the end is screwed on by a key fitting an hexagonal portion behind the flange. The rounded end, J^2, has a screw plug at J^3, for admitting the oil. The opposite end of the box is cast with an enlarged annular portion embracing the grooved collar, B, and the oil for lubricating this end of the journal is put into this chambered part, the groove in the collar assisting in its retention. By the aid of the internal collar, G, a superior frictional area is presented to the working face of the nut, I, whilst the inner annular chamber assists the lubricating action.



BLACKENING FOR FOUNDRY PURPOSES.

Ebenezer Bow, *Glasgow.—Patent dated January* 9, 1855.

That "bone of contention," the curious Boghead or Torbane Hill mineral, has found a new use at the hands of Mr. Ebenezer Bow of Glasgow, who has applied it to the purposes of the ironfounder, in making "blackening" for the preparation of foundry moulds. The argillaceous bituminous mineral, hitherto conventionally known amongst practical men by the terms to which we have referred, is prepared for use in the manufacture of "blackening," by subjecting it to the action of heat. It is taken as dug from the earth, and is primarily burnt or distilled, or otherwise treated by a heating process, in such a manner as to evolve and carry off its chief volatile constituents, the solid residuum or cinder alone being retained and applied in the preparation of the blackening. This residual matter or cinder is ground or reduced to the condition of a powder in any convenient manner, and the reduced mass so prepared is treated in the ordinary manner as pursued with the substances hitherto used in the manufacture of blackening of the common kind.

The blackening prepared in this manner is of excellent quality, and it is much cheaper than that usually employed. Although the "Boghead and Torbane Hill minerals" have been mentioned as the material essentially suited for the manufacture of blackening according to the invention; yet, as there has hitherto been much difficulty and many differences of opinion on the subject of the nomenclature of the mineral substances referred to, we take it to be understood that the names or terms used are merely guides to indicate the general character of the minerals or coals which have been found to be practically available for the purposes of the invention. All coals or mineral substances of the class or family which we have indicated, or embodying the general constituents of these minerals, and parrot coals generally, are suited for carrying out the invention.

CENTRIFUGAL PUMPS.

J. E. A. Gwynne, *London.—Patent dated September* 22, 1854.

From the time of the Great Hyde Park Exhibition to the present, the name of Gwynne has been most closely connected with the progress of centrifugal pumping, and the world has, therefore, had the benefit of the labours of a step-by-step observer and improver, who, with assiduous perseverance, has tested his position at every stage, and advanced to the right or left accordingly.

Mr. Gwynne's present improvements refer to a new mode of arranging the admission water-ways; a newer arrangement of the pump-case; a new form of rotatory piston; and some new contrivances in valves.

Fig. 1 of the engravings is a transverse vertical section of one of the improved pumps, and fig. 2 is a side elevation corresponding, one-half of the case being removed to show the piston within. The admission ways, A, for the water, are in the form of a semi or semi-oblong cylinder, one thoroughfare being in each half case. The passages are carried in a gradually inclined direction into the mouth or centre of the rotatory piston, or wheel, B; or they are constructed so as to discharge into a cylinder, C, forming part of the pump-case, the piston working in easy contact with the inner ends of the cylinders. The external ends of these passages have separate end flanges, one carrying a simple step for the support of the end of the piston's spindle, and the other a stuffing-box for the spindle to pass through from the driving side. These water-ways, A B, are made so that one core or mould-box makes the core or mould for both, and in this way the passages on each side of the pump are made of exactly the same area; and the quantity of water passing into the piston being the same through each water-way, the fluid pressure upon the two sides of the piston is balanced. Any wear between the piston and the case is compensated for, by the introduction of a metal ring, D. The admission ways, A, are carried downwards through the bed-plate of the pump-case, uniting with one on or below that plate, whence the duct passes to the fluid to be raised. Curved diaphragms, E, are placed in the cylindrical passages, C, to conduct the water with a gradually inclined motion in the direction of the impelling force of the revolving piston.

Fig. 1.

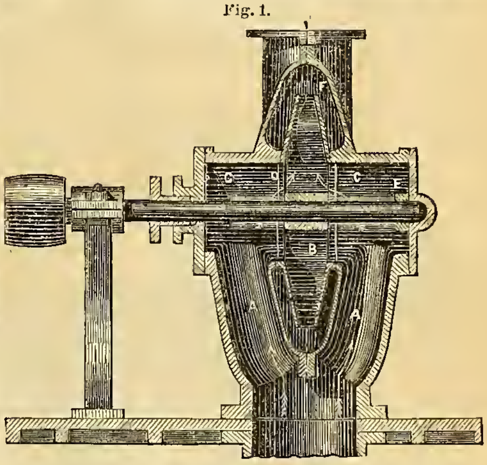
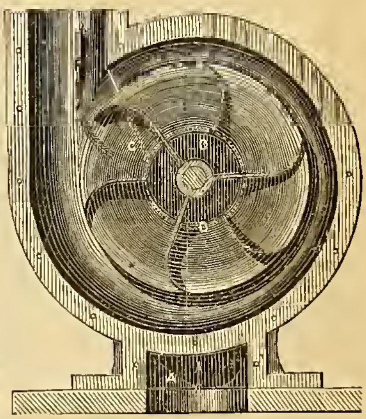


Fig. 2.



The passages or acting vanes of the piston are either radial or slightly inclined, being bent or curved backward near their outer ends, the special form of the vane being suited to the working velocity of the piston, and to the height to which the fluid is to be raised. The vanes at the centre of the piston are so made, that they enter the fluid with a screw-like action without concussion. The periphery of the piston, where the water is thrown off, is made with a slightly expanding curve to facilitate the fluid discharge. The discharge duct, F, commences at the centre of the piston, and the latter revolving in close contact, without serious friction, with the inner side of the discharge pipe, G. This prevents the rotation of the water.

Fig. 3.

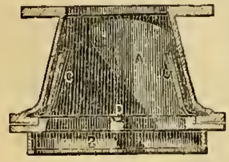


Fig. 3 is a section of a foot valve made according to Mr. Gwynne's invention. The case, A, is bell-mouthed, to insure a full fluid stream, and its wide lower side has a perforated diaphragm, B, to keep out foreign matters. The working valve is composed of two leather flaps, C, defended by iron plates. Their free ends rest when down upon a ridge, a centre bar, D, on which the leather edge makes a good joint.

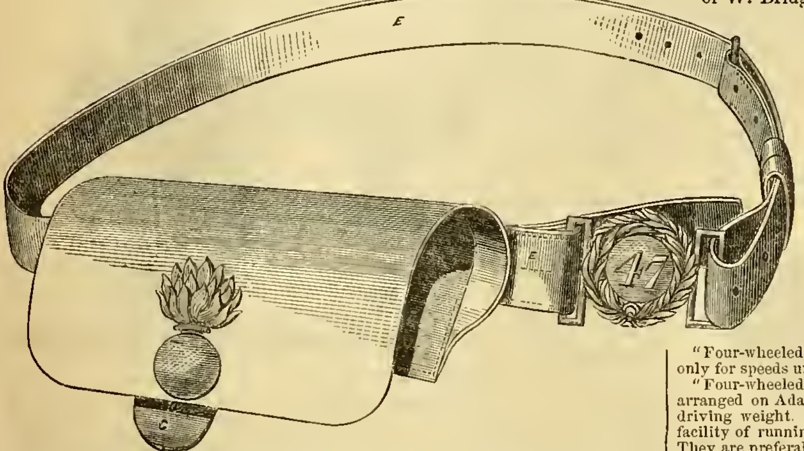
REGISTERED DESIGN.

PERCUSSION CAP AND CARTOUCHE POUCH.

Registered for C. F. Dennett, 5 *Lansdowne Villas, Notting Hill, and* G. Pays, 260 *Oxford Street, London.*

Messrs. Dennett and Pays have combined their ideas with the intention of producing a lighter and more capacious, though less bulky percussion cap and cartouche pouch, than has hitherto been used either in the cavalry, infantry, or naval service. The new pouch is waterproof both inside and out, and it is especially adapted for Indian service, and all climates of variable temperature. It is equally impervious to damp, and to the attacks of the destructive insects of tropical climates.

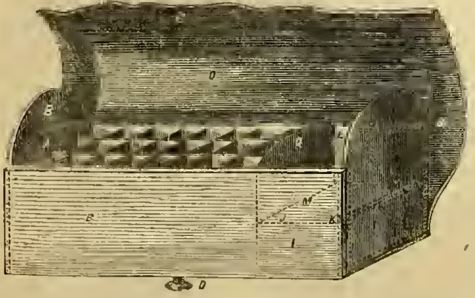
Fig. 1.



It is intended to be worn on the body-belt or pouch-belt. Fig. 1 is a perspective view of the pouch and strap complete; and fig. 2 is a view of the pouch as open and without its strap.

The actual receptacle for the caps and cartridges consists of a japanned metal box, A, enclosed in the leather pouch, B, the flap of which is fitted with a tongue, C, to button on to the stud, D. When the pouch is intended for the infantry service, the suspending straps, E, are passed through loops on the ends of the pouch, and are secured to the under side of the same by buckles.

Fig. 2.



The section of the box intended for holding cartridges is subdivided into twenty-four square cells, H, each large enough to contain a single cartridge. The division pieces of these cells are composed of japanned metal. The reserve supply of caps is contained in the bottom end chamber, I, closed by the lid, J, hinged at K, and opened by the small hooked wire, L, attached to the lid. The cap chamber is separated from the cartridge chamber by a division piece, Q, curved at the top to fit the lid, and so prevent the caps from being shaken over into the cartridge chamber. The caps intended for immediate use are contained in the upper chamber, M, and they rest upon the lid, J, which is prevented from falling down by the small stop, N. The entire box is closed by the curved lid, O, hinged to the back of the box.

Our military and naval readers will easily see the advantages which this clever arrangement offers in attaining the points which we have indicated.

REVIEWS OF NEW BOOKS.

English Pleasure Carriages. By W. Bridges Adams. Charles Knight. 1838.

Road Progress. By W. Bridges Adams, Engineer. Luxford: Whitefriars' Street, London. 1850.

Construction and Duration of Permanent Way. By W. Bridges Adams, Institution of Civil Engineers. 1851.

Practical Remarks on Railways and Permanent Way. By W. Bridges Adams, Engineer. Wilson: Royal Exchange, London. 1854.

Railway Machinery. By Daniel Kinnear Clark, Engineer. Blackie and Sons: Edinburgh. 1855.

Patent Specifications of Railway Improvements, from 1835 to 1854, of W. Bridges Adams, Engineer. Patent Office, London.

II.

Mr. Clark, in speaking of the effect of the height of the draw bar, as compared with the driving axle, points at the fact of the *Euclid* engine, on the Edinburgh and Glasgow Railway, drawing a heavy load without slip, an acknowledgment that the engine has a tendency to slip. The draw bar is 10 inches above the centre of the axle. The reverse of this is sometimes practised in road carriages, the splinter bar being lowered for the purpose of enabling the draught of the horse to lift the low front wheels out of holes and over obstacles.

In summing up practical rules for the disposition of the axles, and the distribution of the load, Mr. Clark says—

> "Four-wheeled engines should never exceed 18 tons weight, and should be employed only for speeds under 20 miles.
>
> "Four-wheeled engines, not exceeding 12 tons, may be employed for high speeds, arranged on Adams' pattern, with an overhanging fire-box, to secure a sufficiency of driving weight. For such light engines, four wheels are perhaps preferable, where a facility of running either end foremost is desirable, as on short lines and branches. They are preferable also for quick curve lines, where a short wheel base is conducive to safety. In Adams' design two-thirds of the whole load are available for driving weight, and one-third for leading."

The datum question to determine the limit of weight in four-wheel engines is, what the rails can bear without crushing or laminating. If the rails be flexible, they will carry a larger load without crushing than if inflexible; but if the rails be flexible, they will absorb power uselessly, without yielding efficient foothold. When the rails are made inflexible, as they should be, the limit of weight without crushing will be found not to exceed four and a half tons per wheel. If, therefore, an eighteen ton engine be used, the weight should be equally divided over all the wheels. To do this, the boiler should be lengthened to counterbalance the fire-box.

Mr. Clark next enters upon a description of his plates of engines and their construction, and he gives a sheet of diagrams of engine framings by various constructors, which are exceedingly various, double and single, iron, and iron and wood combined. Many of them look as if "weight were of no consequence on railroads," as though rails were indefinitely strong, and iron indefinitely cohesive. In describing this sheet of diagrams, Mr. Clark thus speaks of Mr. Adams' engine—

> "*Outside Cylinder Framing,* No. 16, by W. B. Adams, is very simply arranged and directly connected; two plain bars from end to end constitute the side frames, carrying the cylinders, and with inside bearings for the axles. On the small scale of this engine, less than 12 tons weight, outside bearings for the carrying axle are perhaps not worth providing for. To Mr. Adams is due the distinguished merit of having originated the modern light engine system, so generously and so ably brought forward by Mr. Samuel on the Eastern Counties Railway."

This second criticism appears to neutralize the first, in describing it as with "the old fault of overhanging fire-box, and unfitted for running alone."

The truth seems to be, that Mr. Clark, at the outset of his work, had not gone into the depths of railway philosophy as a system, but was too much taken up with the details to grapple with it as a whole; and as he got through the details, it dawned upon him that there were many points more than one point of view, and he corrected his early impressions accordingly. We are not surprised at this. It has been our own case also, and we think Lord Byron quite wrong in imputing as a blame to the instructress—

> "That she herself by teaching learned to spell."

We think we also trace the same fact in the history of Mr. W. Bridges Adams' mechanical career. In the earliest work published with his name in 1838, his motto, taken from the "Characteristics of Goethe," was, if we remember rightly—

> "He would fain keep a hold on the actual; knit the new securely to it, and give to them both conjointly a fresh direction."

And as his perception grew of mechanical defects, he seems to have deemed it a point of conscience to devise a practical remedy, and in most cases he has recorded them in his patent specifications. It has indeed been objected to him, that he was in advance of the time, and that he did not sufficiently push his inventions. Upon this point we shall content ourselves with remarking, that, *prima facie*, it is a part of philosophy to perceive, and that, if practical men refuse to use a far advanced invention, the fault rather lies with them than with an inventor, who probably might have a distaste for going about the world praising the excellence of his plans like a quack doctor. We criticise the specifications of Mr. Adams, as we would any other literary mechanical work.

In one of the earliest patents of Mr. Adams, in 1837, were embodied, amongst others, two prominent objects. The first, the construction of an elastic spring of single plates, not laminated, and reducing the friction to a simple movement round axle bolts. The second, an arrangement of railway trains, in which each four-wheeled carriage was hinged vertically in the centre, so as to form practically a pair of two-wheeled carriages, in which the axles could radiate to curves, so that, when the train was coupled, they consisted of a series of two-wheeled carriages, but with power of extension and collapse by the spring buffers placed between every pair. The wheels were loose on the axles, and were devoid of flanges, their place being supplied by horizontal guide wheels bearing against the rails. Every arrangement was thus provided for getting rid of friction, the axles being also permitted to revolve in their usual bearings. The guide wheels were never tried, as Mr. Adams satisfied himself that their theoretical advantages would be more than compensated by practical disadvantages, and it was left to M. Arnoux subsequently to practise the plan on the Paris and Sceaux Railway.

The vertical jointed carriage was put in practice on the Birmingham and Gloucester Railway, and we believe successfully. That no more were built proves nothing beyond the fact, that railway trains had become stereotyped, and a single new type was lost sight of in the mass.

The bow springs were considered at the time a decided hit, owing to their great ease at the then speed of twenty miles per hour. As speed increased, they facilitated the discovery that railway carriages overhung their bases in many ways, and were top heavy; so that the paradoxical problem was, how to make a spring without movement. In Hamburg, Mr. Lindley used six-wheel carriages, 30 feet long, on bow springs, for the Hamburg and Bergerdorf line. They set the fashion, and the bow spring, now hardly known in England, is the spring of preference in Prussia.

In 1839 we find a patent, containing, amongst other things, railway wheels, formed with double layers of wood felloes between the tyre and the body; springs of various kinds of single plates, of bowed form, acting by extension and compression; half springs of the laminated construction, arranged with the butt ends bolted to the framing, and the taper ends suspended beneath the axle-boxes, thus eluding the blow at the flexible point; also several improved modes of jointing four-wheel railway carriages, to enable the axles to radiate to curves, and a peculiar kind of brake, to act on the rails, and save the wheels from damage. Some few sets of the wheels were applied, and found to answer; but as no manufacturer had an interest in them, other wood wheels were gradually applied. But Mr. Adams' were the originals of all the wood wheels now used.

In 1840, we find another patent for elastic external buffer and traction springs in single plates, with outside buffer bars; for railway wheels, with elastic spring spokes; for self-acting railway brakes; for radiating axles; for guiding bogie frames, and keeping wheels in position by radius bars without axle-guards. Of these, only the buffer springs got into use, but were objected to as too elastic.

In 1846, Mr. Adams took a patent for the application of steam carriages on railways; also for the construction of locomotive engines on four wheels, with the boiler hung low, and the axles beyond the ends, the axles being divided at the mid length, to use the wheels on either side at pleasure, and with a cylinder to each wheel; for sledge brakes, bearing on the rails, and saving the wheels from damage; for end bearings to axles; for rib and hollow steel for laminated springs, the ribs lying in hollows alternately, to preserve parallelism; for springs, formed of discs of steel; for non-recoiling air buffers, self-charging; for coupling rigidly together a pair of four-wheel carriages, to form one eight-wheel, provision being made for lateral play and radiation of the axles; and for hollow buffer rods, and cup-and-ball buffer heads, with swivelling buffer springs, so as to keep the carriages at the same level, one spring helping the next, and practically equilibrating.

The steam carriages were brought into use to some extent, and they did their work well; but whenever they were applied to work a small traffic it rapidly increased, and they had both goods wagons and passenger carriages attached to them. Ultimately it was found that boilers and broad cloth did not do well in the same workshops, and the plan was discontinued. Sledge brakes were constructed, and were not put to use, because a superintendent did not fancy them after the engineer had ordered them, and it was not judged wise to send a new thing two hundred miles off to an unwilling officer of a line. The disc springs and the ribbed springs were largely used. The non-revolving air buffers required too large a diameter to suit carriages, and no opportunity offered to try them as terminus buffers, though well adapted. The swivelling buffers were applied to many double eight-wheel carriages, but not the cup-and-ball kinds. The eight-wheel carriages were 9 feet in width by 40 feet in length, and they are the steadiest and most economical carriages that exist for size of floor area. But there were several disadvantages. The wheel-moving arrangements were badly contrived by mismanagement, and they were on lines conspicuous for their "dog's hind-leg" kind of curvature, and the great increase in width did not suit existing platforms. Moreover, they were unluckily constructed as saloons, which did not suit non-gregarious travellers; and so a plan eminently useful, and which would have ultimately solved, in the only effective way, the question of communication between guard and driver, by leaving a passage way through the train, without interfering with passengers' privacy, was left in abeyance. There was another difficulty. Ordinary carriages are made to turn on turn-tables, and the long carriages required shunting on sidings. In short, to work a line with the best kind of stock, the line should be laid out purposely. Improvements in existing lines are an almost insurmountable difficulty. A carriage of this class is shown by Mr. Clark, with bow springs, in Plates 37 and 38.

In 1847 another patent appeared, containing a number of Mr. Adams' improvements in railways. In this is contained, first, the fish-joint, known far and wide, and sundry other improvements in rails; secondly, the split rail, or rail in two halves, attached together by a break-joint; thirdly, steel and steeled rails, to resist crushing; fourthly, spiral fire-tubes for locomotive boilers, to permit expansion and contraction, and a better impinging of the heat; fifthly, railway wheel tyres, with an internal rib near the front edge, to bolt the body of the wheel laterally, without piercing the tread of the tyre, and thus allowing it to be worn down very thin, while maintaining its circular form by means of the rib; sixthly, grease and oil-tight axle-boxes, the first ever applied upon railways, by stopping up the back of the box elastically, to keep in the grease and keep out the dirt.

Of these various improvements, few came out so very largely as the fish-joint and the split rail. The rib-tyred wheels, so obvious an improvement, were not used, because a deeper pecuniary interest was engaged upon wheels of inferior structure; amongst them, the "safety retaining rings," a substitute for the rib, at once more costly and less effective. The grease-tight axle-boxes have also been largely used, and we may add misused, to the prejudice of the inventor, whose best plans have been obstructed, to make way for spurious things that have unfairly damaged the inventor.

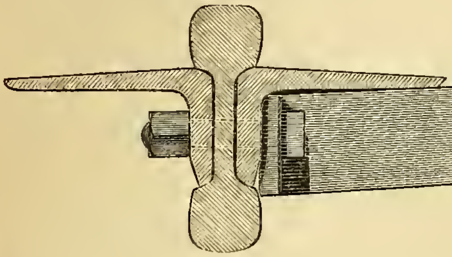
In 1851, Mr. Adams took another patent for several improvements in railways. First, a system of girder rails; that is, rails made laterally and vertically stiff, either of one piece or compound, one important feature being the suspension of the rail by its lateral wings or brackets, so that the horizontal bearing surface on the ballast is as close as possible to the tread surface of the rail, while the lower part of the rail descends, like a keel, into the ballast, and there is no tendency in the rail to rock or work loose by the leverage of the engine wheels, or to crush down in detail, the rail being vertically very deep, and the bearing continuous.

There are also various modes of applying stone and slate sleepers in combination with wood; and modes of making a system of portable railways for farms, or for the army; a new joint chair; and a system of rails, serving as drain pipes; coupling light engines together in pairs, to be driven by one man; improved sledge brakes, of two varieties, bearing on the rails—one variety shown at Plate 51; flat roofs, of great span, for stations, on a tension-net principle.

In this patent, Mr. Adams shows no less than eighty-three diagrams of rails; and we give the following woodcut, as illustrating the general principle and latest improved plan, by which it will be seen that a reversible rail, 7 inches in depth, is suspended within 2½ inches of the tread, by a horizontal bearing surface of 14 inches, while the keel is 4½ inches below. There are but four parts, of which the whole way is a multiple —the rail, the side bracket, the bolt, and the guage bar. There are no sleepers, and therefore this rail is well adapted for hot climates and rude countries, from its indestructibility and facility of laying down, for which purpose, we believe, it is about to be applied.

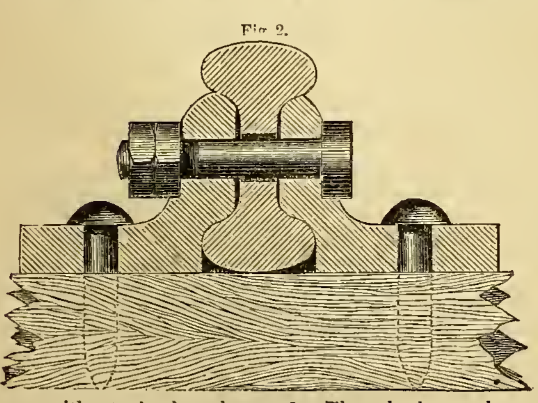
In February, 1853, Mr. Adams patented a number of improvements in rails and girder rails, and of various modes attaching them to sleepers, both of cast-iron and of timber. One mode of attaching double or single hind rails to sleepers is very simple. There is no chair whatever, but the rail either lies on or is bedded into a hollow groove of the sleeper, whether of metal or timber; and to keep it in position, side brackets of angular form are bolted to and through the rail by the vertical portion, while they bed in and are bolted to the sleeper by the horizontal portion; or, in some cases, the brackets may lean against the rail without being bolted through. At the joints the brackets are 15 to 18 inches long, with one, two, or four bolts through the rails. The intermediates are about the usual length. The advantages are great. The rail is lowered two inches on the sleeper, neither top nor bottom table is damaged, and it can be reversed at any time. All blows and clatter of common chairs are removed, while two-thirds of the weight of the ordinary chairs suffices. This system is getting largely into use on many lines, and amongst the testimonials to its value are two very strong facts. One month after the date of Mr. Adams' patent, on February 17th, Mr. Charles Heard Wild, C.E., a director of the Permanent Way Company, took out a patent for, and ultimately specified a duplicate invention of, the same thing; and on the 9th of May, 1854, Mr. Charles Liddell, C.E., patented, and subsequently specified, a triplicate invention of the same thing.

Fig. 1.



In Dec., 1853, appeared a patent of Mr. Adams for improvements in wheels, axles, and boxes. These are disc or solid wheels, with tyres ribbed internally, to which ribs are bolted laterally the discs of timber or of iron, without piercing the tread. The wheels are shown loose and fast. The axle journals are formed with a flange or collar at the centres of the bearings, thus removing the necessity for shoulder or front collars, which are dispensed with, and the centre collar is thus removed from all dirt. The bottom of the box is of wood, and the end of the axle has a horizontal leaning against the box, to prevent end play.

Fig. 2.



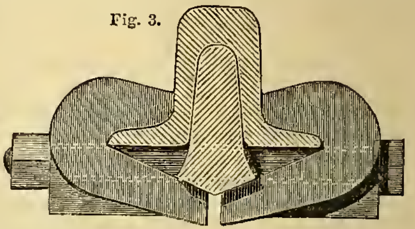
In 1849, Mr. Adams patented some improved rails; one kind, the double I, with horizontal ribs, to give lateral strength, and several improved brackets for joints and intermediates. In the same patent is the improved form of suspended girder rail we have before shown, and a truss joint for bridge rails, coming largely into use, as the only form of bridge-rail that has yet appeared which really holds the two rail-fastening ends together, independently of other fastenings and supports, and causes them to become a continuous bar.

We perceive another of Mr. Adams' patents in the lists of 1855, for improvements in springs; but we are not yet behind the curtain as to what kind of improvement it may contain.

We have confined ourselves to such patents as belong to railways. His improvements in fire-arms and steam-vessels, and other things, do not come into the present category.

In "Road Progress," Mr. Adams opens up many questions regarding the mechanical philosophy of railways, from the locomotives to the trains, and the rails they run on. In his *Practical Remarks on Railways*, he again states concisely the whole question of engines and rails. He then goes on with an original line of argument, in which it will be possibly assumed that he is before his time. However, he considers that railways must ultimately be nearly as various as the general necessities of traffic. He has been the first to promulgate the principle, that sooner or later a new class of railways will arise, which he denominates "high-speed lines," to be used for passengers only, at the highest rates of speed, and on which lines goods will never be suffered to travel. He states his belief, that with a good rail, not crushed, and with light engines and trains, and all times at the same rate of speed, travellers may be carried cheaply at the rate of 50 to 60 miles per hour; and that such railways can be made—Parliament aiding and not obstructing—at the rate of about £15,000 per mile double. And that the vehicles might be of such a structure as to give the maximum of ease and comfort to the traveller, who might even be provided with places of refreshment, as in a steamer on the river. He thinks that thus London and Liverpool might be a single day's journey, going and returning, with several hours' interval for business. And we think that such will ultimately be the case between London and Paris.

Fig. 3.



Mr. Adams classifies the alternate railway lines as high-speed lines; local lines; highway lines, or lines of rails laid on highways; street lines, as in the American cities; city tunnel lines; city arcade lines; agricultural lines, and moveable or portable lines. And the patents before described are apparently the mechanical means for the development of these ideas.

To return to Mr. Clark. Leaving for a time the question of locomotives, he enters upon the physiological principles of carriages and engines with the following note:—"For the line of argument pursued in this introductory section, and for the substance of the reasonings and deductions, the author is indebted to Mr. W. B. Adams, than whom few men have done more for the advancement of railway transit. The author has also largely availed himself, by direct quotation, of unpublished MSS. kindly placed at his disposal by Mr. Adams."

This chapter is, in fact, a *resumé* of Mr. Adams' experience and deductions in the practice and philosophy of railway transit; and it is summed up in a recapitulation of seventeen heads, which we recommend to the serious attention of the makers of new lines, for any improvement in old ones becomes almost an impossibility in essentials. If Mr. Adams' passenger lines shall be brought to pass, it will be easy, and high speed can only be developed by new lines. The great distinction between running high and low speed together on the same lines, comparing highway with railway, is, that on the highway the travel may be varied at pleasure, by slow vehicles getting out of the way. On the railway they follow each other by necessity, and the mere multiplication of the lines of rail will not do. It involves dangerous crossings, the pulling down of bridges, the widening of tunnels and removal of stations, and lastly, the purchase of new land, which has already assumed a greatly increased value by the advent of the railway. Both for public service, for cheapness, and for the advantage of existing companies, it is desirable that high-speed lines should be quite independent of them. They will earn more money when they develop thoroughly their own legitimate traffic, than by unhealthily seeking after the small per centage of fast travellers, who impede their more important avocation. A different system of locomotives and trains is as much required for the several purposes, as were road waggons and mail-coaches for the slow and fast traffic on highways.

A chapter follows, detailing certain arbitrary forms and construction of carriages and waggons. In treating of buffer springs, Mr. Clark gives a preference to volutes, as compared with the long double-armed laminated buffer. There are, no doubt, many circumstances in which the volute is preferable for purposes of allocation; but there is one consideration in buffer springs which is important, the swivelling at the centre to give equal pressure of the buffer head, whether on straight lines or curves. For this purpose the volute is not fitted.

With regard to the quantity of steel used, we believe that it is independent of form, whether volute, disc, bow, single plate, or laminated spring; that is, each class being set out to the best form of its kind, a given weight of steel will produce the same results, in length of stroke and strength of resistance. And we believe that the same result will be obtained when the material is caoutchouc. For example, Mr. Clark states, p. 267, that 56 lbs. weight of steel are required for a buffer of six inch stroke in the volute form. Therefore, the ordinary 12-inch stroke will require 100 lbs. for one rod. The two rods sum up 200 lbs., or 400 lbs. per carriage. Now, 400 lbs. of steel, well disposed, will form two very powerful laminated buffers, serving also as draw-springs, which in the volute form require to be separate. Still the volute is very convenient for many purposes; but it is not lighter or better, and the weight of steel buffers is better disposed in the centre of the carriage than at the ends. The royal saloon carriage on the South-Western Railway is conspicuous for a huge black box, well disposed centrally below the framing between the wheels. The box contains pig-iron ballast, to weight the springs and keep the carriage steady; a serviceable arrangement, when we reflect that the huge mass only carries two passengers, and there is no other way of rendering it at once easy and steady. A light carriage, in which a full load of passengers constitutes the ballast, must always be uneasy when partially loaded. There is another objection to a single volute—its rotating action. Mr. Clark was, we believe, the first to overcome this difficulty, by placing two volutes together, revolving in the same direction, which removes the difficulty.

In his chapter on Wheels and Axles, he accords his preference for disc wheels to spoke wheels, and says—

> "Adams' wood disc wheel is superior to Mansell's. It has not yet been tried. A flange is rolled on the tyre, by which it is bolted on to the disc, and simply fastened to it. There are no bolts through the tyre, and it may be worn down nearly to the wood. Adams' disc wheel, with a chilled tyre, is also remarkable for its simplicity. This wheel, if properly worked out, will make a simple and durable wheel. The wheel is free to turn on the axle, and the axle is free to turn on the axle-boxes. . . . . In a perfect system the wheels must be loose on the axles."

Mr. Clark goes on to say, after treating of axles and the form of journals:—"We must one day arrive at loose wheels, turning independently on axles, when there will cease to be any practical advantage in the hollow over the solid axle."

We dissent from this. A hollow axle, were it perfectly manufactured, is in every respect superior to the solid. It is lighter and stronger, and admits of a free circulation of air, if properly arranged. It might be used in many advantageous ways. But it has got out of repute by injudicious attempts to reduce a large cylinder to a small one—to form a rectangular journal, which cannot be done without destroying the equal thickness of the metal; and therefore the hollow axles break off at the shoulder; forged down as a double-cone journal, in the manner of the "broad guage," and with a central flange or collar, as proposed and patented by Mr. Adams, the hollow axle would retain its equality of metal, and would not be subject to break; and the central collar of the journal, enclosed from the dirt and dust, would not be exposed to wear, but maintain the axle in position, without mischievous end play.

In his chapter on Axle-boxes and Springs, Mr. Clark gives Mr. Adams, in his patents of 1846–7, as the original inventor and patentee of axle-boxes for retaining the grease, so as to bathe the axle-bearing from below, and also of the mode of providing for end wear independently of the collar bearings. Mr. W. A. Adams of Birmingham, an extensive hirer of waggons, likes to have a shoulder-collar of ⅝ths of an inch, with a bearing 3 inches by 6 long. This, therefore, will require an axle 4½ inches diameter where passing through the wheel. But it is clear that the bearings should be proportioned to the load carried, and these bearings are used for a load of 6 tons 6 cwt., exclusive of the waggon—probably 1½ ton more—total, 8 tons; or 2 tons per axle. When a shrewd builder, with a profit to make on his own property, adopts a plan, the chances are that he is right as to his own interest. But we have occasionally heard the remark—"As a builder and hirer, I prefer a heavy waggon; as a director, I should prefer a light one."

After descriptions of axle-guards, springs, and brakes of carriages and waggons, Mr. Clark inserts a chapter by Mr. W. Bridges Adams, giving the history and mechanical philosophy of brakes.

The third part of Mr. Clark's work treats of Permanent Way, compiled from Mr. Adams' paper read before the Institution of Civil Engineers, and which stands, amongst others, at the head of this article. Mr. Clark says—

> "This paper contains, so far as we know, the only systematic investigation of the important question of rails; and it is written by one who has made himself master of the subject, and who has the qualifications necessary for giving a reason for the faith that he holds."

In the discussion on Mr. Adams' paper at the Institution, Mr. Adams' views were strongly combated, and the various opinions given are on record in the publications. Mr. Clark has not quoted them, but we particularly call attention to the accuracy of Mr. Adams' criticism of the saddle-back Barlow rail, then in its infancy, *à priori*, and the attack of Mr. Brunel on Mr. Adams' statements, also *à priori*.

Mr. Brunel is, by his own estimate, a genius, and geniuses are erratic; and we can quite understand that he would prefer the reputation of being the only inventor extant, and therefore he naturally dislikes patentees who make claim by a record that they, and not he, are the "just and true inventors." We need not, therefore, quote Mr. Adams' reply, but merely state, that Mr. Brunel's opinion on the saddle-back rail in 1852, has become less than nothing by the practical results of Mr. Brunel's adoption and trial, as a journey on the West Cornwall will demonstrate.

With regard to drain rails, Mr. Clark quotes from Mr. Adams' paper:—

> "Impressed with this defect, the author was led to consider the practicability of getting the drains closer to the sleeper; and the most obvious mode was to make the sleeper itself the drain, by constructing it of perforated iron; or supposing iron rails to be used without sleepers, to make the rail itself the sleeper. The plan proposed to accomplish this is to roll a rail into a deep, thin, vertical web; two angle pieces of cast or of sheet iron, bent to the requisite form, are bolted to the rail above and below breaking joint. These angle plates are perforated, and the water will find its way through the perforations precisely as it does in ordinary clay drain-pipes, and may be led away to the exterior at convenient intervals."

Mr. Clark concludes this chapter by the absolute necessity of trying new things experimentally; "trying everything appearing theoretically right, and that cannot be theoretically demonstrated to be wrong."

An important subject comes next, which our space will only permit us to glance at—the resistances of engines and trains. This appears to be thoroughly and well worked out and tabulated, with the skill of a master. One remarkable statement we must quote:—

> "The result of the Caledonian experiment, which we believe to be an average one, is then 8 lbs. in excess of that due by our broad guage formula, *amounting to* 40 *per cent.* We are disposed to convert this particular result into a general conclusion, and to infer generally, that the tonnage resistance on the narrow guage, under the circumstances of our trials, was 40 per cent. in excess of that on the broad guage. The greater part of the excess is unquestionably due to the superiority of the road. . . . It appears inexpedient to use inconveniently large wheels on good roads, and they are advisable only on inferior roads, such as ought not to exist. . . . The great element for improvement is the permanent way, and it appears almost ridiculous that such infinite pains should have been bestowed on the rolling stock for its improvement, while the road, an equally important element, should have been comparatively neglected."

The great advantage the broad guage has, is, we conceive, its great lateral strength of rail, diametrically opposite to the double I, which between the chairs is very weak, and yields irregularly, constantly changing the tread on the coned diameters of the wheels, and of course involving friction. From this defect the bridge rail is free, though it has the other disadvantage of being weak vertically. The top heaviness of the narrow guage trains is another disadvantage, and their length, disproportioned to width, giving so much more atmospheric frontage. Bad construction of carriages is another element. We have heard of a train that absolutely would not run down an incline of 1 in 75, without being pulled by the engine. The proportions of length to breadth on trains is better on the broad guage than on the narrow; but without loose wheels, the length of axle is an enormous disadvantage on curves.

Rules and tables for the proportions of engines are then given, and also tables of performances. Switches and crossings, turn-tables and traversers, are then dealt with. Waggon-hoists, luggage slides, incline gearing, water tanks, water pumps, cranes, coking apparatus, signals, and weigh-bridges, conclude the work; to which is added a very copious index, got up with far more care than is usually bestowed on such a matter, important though it be in a work of reference. Also a copious table of contents, which reminds us of a similar one in Mr. Farey's work on the steam-engine. And we now turn to an examination of the preface, a portion of a work usually written last, and in a work issued in numbers necessarily read last.

Mr. Clark states that the "locomotives was his chief object of study." There can be no doubt of this, and that he has studied to good purpose, for his own knowledge and the instruction of others. We believe that Mr. Clark commenced with an absolute belief in inside cylinders, which he gradually modified; and finally, with the results of balance, so altered his opinion, that he constructed outside cylinders by preference. He thus also opens the mouth of the mine, in which we must dig for further progress, an acknowledgment that, "though much is taken, much abides:"—

> "In the department of internal economy, the field is not yet fully explored, and much remains to be accomplished, in relieving the slide valves, by removing the steam pressure from the ends of them, superheating the steam, heating the feed water, and other steps of improvement.
>
> "While on this subject, the important results recently obtained by Mr. C. William Siemens, from his Patent Regenerative Steam-engines, must be remarked. These engines consist of three cylinders, and the principle of their action is, that a given volume of steam is alternately expanded and compressed, and is simultaneously with these changes superheated, and restored to its normal state of saturation. Thus the duty of the fuel consumed is only to replace the heat directly absorbed in expansion behind the working pistons. The latent heat of the steam, which constitutes by far the greater proportion of heat expended in ordinary steam-engines, is preserved, and a corresponding economy is effected, amounting practically, it is said, to more than two-thirds of the fuel consumed by the best engines at present in use. Some years since Mr. Siemens invented the Regenerative Condenser, by which the condensing water of condensing engines was heated to the boiling point, at the same time effecting a vacuum. By the employment of this heated water to supply the boiler, a valuable saving of fuel was effected. The portion of water so used was necessarily but a small portion of the whole quantity heated; and the regenerative engine may be considered as an extension of the idea of returning the heat to the boiler, because not only a portion, but the entire latent heat of the steam is returned to the engine."

Mr. Siemens is one of those thoroughly honest, hard, and intellectual workers, whose word is but as a voucher for his deed. No Ericsson he, to blow a trumpet blast over every fallacy; and we may assume that, working on these principles, some great change has yet to be wrought in the locomotive boiler, and, consequently, in its machinery. The tables of Mr. Clark will have to be revised, and new proportions devised, and it will not do yet to stereotype the forms, as though perfection were attained. In any case, as we shall not probably rise in air with our mortal coil about us, we must still put our moving power on wheels and springs; and there is no doubt that swiftness must be graceful, and the long engine will be like the long steam-boat, quickest and steadiest on the surface on which it runs. It will not be a haystack form that will achieve sixty miles per hour without risk or damage. If Mr. Siemens can enable us to travel swiftly with five pounds of coke per mile, there will not be much left for the chemist to do.

We are glad to see Mr. Clark mention the name of Mr. W. M. Buchanan of Glasgow, another of the earnest workers of the Dalton school; true, honest, intellectual, kindly, and with nothing of the self-seeker. Such are the men who are scarcely known till they are gone, and the world builds them a monument when dead, to whom in life they scarcely vouchsafe food.

And now to our fiat. We think Mr. Clark has produced a work which workers will value more than literary men. There are in it all the elements for the construction of a railway for those who know how to pick and cull. And, without being in exact order, there is method in it, though much of tautology; and we feel that we could better spare many a better *book*, in the literary sense of the term. We do not find that his opinions are constant even in chemical demonstrations and the definitions of forces. In most of those matters which cannot well be settled by geometry, and which we may consider analogous to the "points of a horse," he wavers from time to time, but always, we think, ascending and improving. There is enough of evidence to show, that the appendix of this writer will be a valuable addition to the work. Many will study the work as a book which will enable them to earn money, and no doubt our American cousins have already "dodged" it in many ways. For our own part, we have examined it conscientiously, and have no doubt of its great utility; and in this our article we think we have contributed something to the general stock of knowledge by the analytic course we have taken. Indiscriminate praise is a very easy task, but such praise could do no good to a work which must finally rest its claims upon utility. We shall be glad to be possessors of the appendix, with the faults of omission and commission amended, and with the drawings of Mr. Siemens' engines converted to the purposes of a locomotive.

The style and form of the dedication put us in mind of the authors of Dryden's time, with the difference that they commonly addressed themselves to a very useless lord, while this is addressed to a very useful commoner—one who would not be made a worshipful knight amongst the common crowd, but was content to remain in his own plain intellectual worth, his father's son. When a book shall be written analysing the merits and demerits of the pseudo-great men of the present day, and Trade jobs shall be estimated at their full value, like Court jobs in those days, it will be well for Robert Stephenson to be present amongst the working men of humanity, and not amongst the Cagliostro men.

Literary Papers by the late Professor Edward Forbes, F.R.S. London. 1855.

These papers are reprinted from the Literary Gazette, in which periodical they appeared, during the last three or four years, in the shape of reviews and notices of books, connected, for the most part, with his own pursuits. If this eminent man had lived, we do not believe that these papers would have been reprinted. They are all very slight, and will add nothing to their author's fame. They doubtless served a certain purpose when they originally appeared, for Professor Forbes was not the man to praise a bad book, or to say an ill-natured thing of a good one. They pointed out, in a few words, the prominent excellences of the work under review, or they denounced, in an equally concise way, those faults which rendered a book worthless. But the immediate object of his praise or blame having been effected, and the notices being too short to possess a permanent value, there was no sound reason for collecting and issuing them again. They bear the marks of having been hastily composed; space seems not to have been allowed him to do more than to express his opinions without advancing his reasons. The author, after doing much, and giving promise of doing far more in his vocation, was suddenly cut off before he had completed his fortieth year, perhaps the severest loss that science has experienced since the death of Fresnel. Young as he was, he had taken rank amongst the leading men of our age, and was looked upon with the greatest respect by philosophers much older than himself in years and science. Patient as he was in the collection of facts and the study of particulars, he was chiefly remarkable for his wide, far-stretching views, which perplexed many and startled all. He had a peculiar talent for synthetic arrangement, for the deduction of a principle or a law from a mass of particulars, and we doubt not that many of the theories he sketched in anticipation of future proof will turn out to be true in the main, though we may have to wait some time before we arrive at the result which, had he lived, he would have laboured so hard to reach and establish.

Edward Forbes was born in 1815, in the Isle of Man, where his father was a banker. He studied at the University of Edinburgh, applying himself chiefly to zoology and botany, for which branches of science his taste had early displayed itself. When eighteen, he made an excursion to Norway, and when twenty-six he filled the office of naturalist to the surveying expedition sent to the Mediterranean under Captain Graves. In 1837, he went to pursue his studies in Paris, and in the following year he put forth a little work on the malacology of Man. In 1840, his History of British Star Fishes began to appear. The year after he was exploring Syria, and he made a second excursion into that country shortly after the first. It was about this time that he carried on the series of observations beneath the waters of the Ægean, which laid the foundation for his celebrated speculations as to the distribution of submarine life. Whilst still engaged in his researches, he was attacked with fever, which reduced him to the point of death, and which weakened his constitution very considerably. He received the appointment of Professor of Botany at King's College, and delivered his opening lecture there in May, 1843. Soon afterwards he was made Secretary to the Geological Society and Curator of the Museum, which latter appointment he resigned on becoming Palæontologist to the Government School of Mines, established in connection with the Ordnance Geological Survey. This office was converted into a Professorship of Natural History, and, in the performance of his duties, the arrangement of the fossils in the museum, and the delivery of a series of lectures, fell to his lot. He pursued extensive geological researches in the field during the latter years of his life. In 1854, he retired from his London professorship, on being appointed to the Regius Chair at Edinburgh, but did not live long enough to deliver any lectures. His last appearance in public was at the meeting of the British Association at Liverpool, where, surrounded by the leading geologists of the age, he filled the office of president in the geological section. On the approach of winter, he was attacked by the disease that carried him off, on the 18th November, 1854, his constitution having been so enfeebled by the fever which seized him in the East, as to be unable to withstand anything of more than ordinary severity. And thus he died, to the great grief of the whole scientific world, but leaving a name which will be long a bright spot in the history of human knowledge.

The Relative Rights and Interests of the Employer and Employed Discussed; and a System Proposed by which the Conflicting Interests of all Classes of Society may be Reconciled. By M. Justitia. Pp. 143. London. 1855.

We are always glad to meet with works of this kind, however little we can approve of the authors' schemes, provided they are not subversive of the principles of society, and are temperately discussed. We are glad to meet with such books, because they show that the wants and sufferings of the poor are receiving the attention of thoughtful men, and hope whispers that in the multitude of councillors there is wisdom. The difficulties surrounding this subject are very great, and it is only by turning it into every possible position, and by means of a full and free discussion, that there can be any chance of the problem being worked out, and the condition of the lower classes ameliorated. The author's scheme is founded upon co-operation, combination, or association. To this principle he looks in order to harmonize capital, skill, and labour:—

> " In order to apply this great principle to social, domestic, and manufacturing life, let a *Joint Stock Company* be formed of any number of persons, who possess the requisite amount of capital, for the purpose of commencing in any branch or branches of business that they may determine upon. The cost of erecting houses and other buildings for the working shareholders, and the purchase of every article required for their domestic use and comfort, should be included in the estimated expenses, as well as the cost of erecting the manufactory, providing it with machinery and raw material. Let such capital be raised in shares of ten shillings, or one pound each; and interest at the rate of five per cent. per annum be paid on all capital so advanced. A dividend of the profits should be declared annually, and each proprietor receive his due proportion of interest and profits, according to the number of shares he may have in the establishment.
>
> "We will suppose that the company decide upon manufacturing portable steam-engines and agricultural machinery, although the principle is equally applicable to any other branch of productive industry. They will require a practical scientific engineer, of trustworthy character and approved abilities, to give an outline of the buildings and machinery necessary for the business, and to fix upon a proper site. He must be able to state the men required in each branch of the business, give his opinion and advice upon any matter in which the company may require his assistance, and be competent to continue as the manager of the establishment.
>
> " We will suppose that there are required collectively, in the various branches of the trade, two hundred first-class workmen, with manager, foreman, and draughtsmen; a sufficient number of houses must be provided for them and for their families, as well as for other persons connected with the establishment, such as a schoolmaster and schoolmistress, a steward, clerks, storekeepers, and the other servants who may be needed. Each dwelling should be distinct, separate, and retired, and provided with every necessary accommodation."

Then the way in which the scheme is proposed to be worked out is described, for which we must refer to the book itself. As far as we can see, the scheme would answer very well if men were perfectly moral beings, and if they could be brought to submit to all the restrictions which the adoption of the scheme would lay them under. But, we confess, we are not sanguine enough to hope that the regeneration of society will be effected by the plan proposed. That plan requires capital at starting; but the majority of the labouring classes have no capital. It leaves out of view all that numerous body who prefer idleness to industry, and that equally numerous body whose physical powers are incapable of labour. Where is the place of the aged and infirm in Justitia's scheme?

The antagonism between capital and labour has been frequently spoken of, and deplored too often, it may be safely stated, by those who looked at isolated cases of hardship, and not at fundamental principles. Here is a story involving what seems a great hardship; but, in point of fact, it only illustrates the case of a man possessing property with which he did not know how to deal:—

> " A very ingenious self-acting machine was invented by a workman, to make a staple article, which was previously only made by hand; the invention was patented, but, before the machinery was completed, his funds were exhausted, and he was obliged to procure aid from a capitalist; however, as the machinery was a longer time before it was completed than the capitalist was led to expect, he became tired, and as the inventor could not refund the money advanced, the patent and the whole effects were sold; this sale did not realize the sum that the capitalist advanced; consequently, the poor fellow, not only lost his invention and all he had, but was greatly *involved* in debt. The purchaser had a number of the machines made, and a factory built, in which to work the invention, where it is working most successfully at the present time. After the sale, the inventor suffered severely from the embarrassed state of his affairs; he was, however, recently permitted to take a workman's situation in the above-named factory, where he is *now* employed, and his invention is accumulating a *large fortune* for his employer, who *only* paid *half the cost* connected with the invention, whilst the inventor receives *no portion* of the profits, and *is still in debt!*"

A Classified Synopsis of the Principal Painters of the Dutch and Flemish Schools, their Scholars, Imitators, and Analogists. By George Stanley. London: H. G. Bohn. 1855.

With a better arrangement, and greater condensation, this would have been a very useful book. The chief value of a work of this kind consists in the facility with which reference can be made to the account of any particular painter, and the amount of information which that account affords within a given space. The arrangement of the contents of the volume before us is confused, and cannot be defended by any satisfactory reason. First, we have an account of the principal painters and of their scholars, imitators, and analogists. The names of the principal painters are taken in no order that we can discover; they are neither alphabetically nor chronologically arranged. Then we have an account of painters classified according to their subjects,—landscape painters, painters of animals and dead game, painters of flowers and fruit, &c., the divisions being no fewer than twenty-one. Lastly, we have an account of the early painters. Now, as several artists distinguished themselves in different ways, their names appear in several divisions, and, instead of finding all that is known about any painter in one place, we have to gather our information from many parts of the book. It is surprising that the inconvenience of such an arrangement did not strike the compiler as soon as he had conceived it. For example, before we ascertain all that the book contains on the subject of Rubens, we have to refer to five widely-separated pages; and as to David Teniers, four places must be sought for. A plan like this, of course, renders the volume almost useless as "a hand-book to the amateur who visits galleries." As to condensation, the same amount of matter could have been given, with a little contrivance, to the saving of many pages, or more information could have been given in the same space.

If Mr. Bohn contemplates any more publications of this kind, we hope that he will see to the adoption of a more convenient arrangement than we meet with in this Classified Synopsis. We are afraid that Mr. Stanley's qualifications for the task assigned him are not of a high order, either as regards the possession of sound taste and judgment, or of the art of composition.

Isometrical Perspective. By Robert Scott Burn. W. & R. Chambers, London and Edinburgh.

These two books on Isometrical Perspective, contain seven and a half pages of text, and fourteen plates. The engravings are neat, but they would have been improved by a little deeper cutting, so as to make the lines stronger. The text, we think, might have gone with increased advantage somewhat more fully into details; but, on the whole, this is a perspicuous introduction to Isometrical Perspective, and worthily forms part of Messrs. Chambers' cheap series of educational works.

An Essay on the Theory of Colour, and its Application to Architectural and Mechanical Drawings. By William Minifie. Baltimore. 1854.

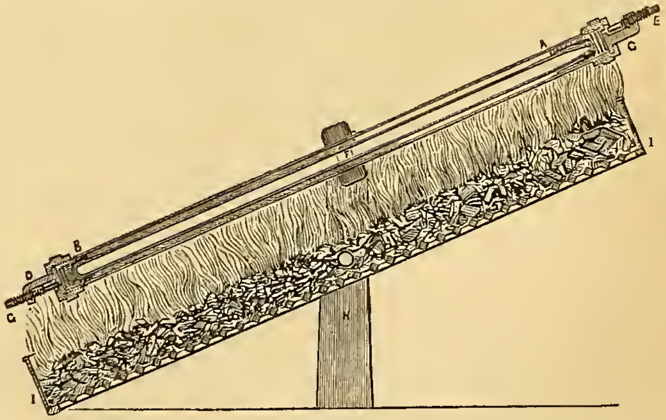
This is a small pamphlet of 28 pages, appearing to be a reprint of the Appendix to the author's Text Book of Mechanical Drawing, already favourably reviewed in our Journal.

CORRESPONDENCE.

NEW MODE OF FILLING GLASS TUBES WITH MERCURY.

As an engineer in the steam marine department of the Royal Dockyard, Hellevoetsluis, I have often found the want of an accurate barometer. Now, inaccuracy in this instrument frequently arises from the imperfect way in which the tube is filled with mercury. My method of doing this obviates most of the difficulties, and I beg to send you a short description of it for insertion, if you think proper, in the *Practical Mechanic's Journal.*

My description will be better understood by reference to the figure. A B is an open wrought-iron pipe, with nicely fitted ends, against which are fixed by nuts the perfectly smooth plates, C and D, so that the pipe is quite steam-tight without any intervening substance; these plates have each a small conical hole, to be opened or shut at pleasure by the ends of the plug screws, E and G. The middle of the iron pipe, A B, is provided with axles, F, which move in the uprights, H, fixed to an ashpan; in the same uprights, rests likewise the fire-grate, I, on axles so that the latter may receive the same inclination as the pipe, B. The whole apparatus is now complete.



After having made the inside of the pipe, A B, perfectly clean, the glass tube is placed inside, with the closed end towards the plate, D, each end being provided with a small wrought-iron open cap. These caps are kept close to the glass by means of spiral steel springs, which press against the plates, C and D. In this manner the glass tube is quite sustained by the tension of the springs, though able to move without touching the end plates, C and D, which are tightly screwed down, as well as the plug screw, G; the plug screw, E, is then taken out, and a sufficient quantity of mercury is poured through a small funnel of boxwood, into the iron pipe around the glass tube.

After replacing the plug screw, E, without closing the hole in plate C, the pipe, A B, is laid above the fire-grate, I, in the position shown in the figure. A temperate fire of charcoal wood is laid on, lest the boiling of the mercury should take place too suddenly; a beating motion will be heard while boiling, but there is no danger of breaking the glass tube, as it is held between the two springs, and all air and vapour will be completely expelled on account of the greater density of the steam of mercury.

After the boiling has lasted for about ten minutes, the hole in plate C is tightly closed by the plug screw, E, and the pipe, A B, is gently moved into an oppositely inclined position; the fire is directly taken off the fire-grate, and the whole apparatus is left in that position till it acquires the temperature of the surrounding atmosphere, and the steam of mercury will be condensed when the fluid metal will have attained nearly the same level both inside and outside the glass tube.

Holding the pipe, A B, in the same position, and opening slowly the hole in plate D, by the plug screw, O, the air will rush in, and the mercury outside the glass tube will sink, whilst it will rise inside, till the tube in this inclined position will be completely filled by the pressure of the atmosphere. This being done, it only remains to take the glass tube out of the iron pipe, which is performed by closing the plug screw, G, and inverting the pipe, A B; by this movement the mercury will flow to the bottom, D, whilst the open end of the glass tube is elevated without losing any mercury, that is to say, completely filled; as the adhesion of the fluid to the glass, favoured by centrifugal motion, prevents any spilling. By unscrewing the plate, C, the glass tube may be taken out, and it is now fit for use. Tubes for siphon barometers may be filled in like manner, it being, however, necessary that the pipe, A B, should not be inverted in taking out the tube.

The advantages of this method of filling tubes with mercury are these:—

1. It is easy of application, and there is no danger of breaking the tube. Therefore, tubes of larger diameter or of thinner glass may be used.

2. The workman has less to fear from the vapour of the boiling mercury, as it escapes only through one small opening.

3. Complete expulsion of air and aqueous vapours, as the glass tube is heated equally over its whole length, whereby the air is not shifted from place to place, but is entirely driven out, so that the smallest bubble does not remain inside the tube, neither can air enter during the whole operation, nor is it necessary, after boiling, to add any mercury at the open end of the glass tube.

4. There is less risk of oxide of mercury forming inside the tube, as the air is kept out of contact during boiling.

5. If by any accident the tube should be broken, there will be no loss of mercury, for it will remain inside the iron pipe.

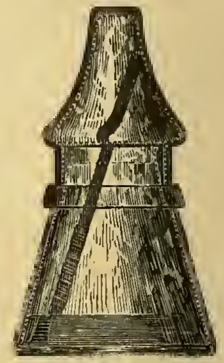
By this method of operating, barometers of great accuracy will be produced, since all air and aqueous vapour will be expelled from the tube; the value of which result will be fully appreciated by every one who is acquainted with their manufacture and their use.

Hellevoetsluis, August 6, 1855. D. VAN DEN BOSCH.

MONTHLY NOTES.

SCIENCE IN BRITAIN.—Some time since, the British Association appointed a special Parliamentary Committee to inquire whether any measures could be adopted by the Government or Parliament, that would improve the position of science or its cultivators in this country. A report has been prepared by this committee, founded upon the opinions of various persons eminent in science, and will be presented to the members of the Association at the Glasgow meeting. Parts of it have meanwhile been printed in the *Athenæum*, and from this publication we borrow the following summary of the recommendations with which the committee conclude their report·—1. That reforms shall take place gradually in the system of any of our Universities which do not at present exact a certain proficiency in physical science as a condition preliminary to obtaining a degree. 2. That the number of Professors of Physical Science at the Universities shall be increased, where necessary, but that at all events, by a redistribution of subjects, or other arrangements, provision should be made for effectually teaching all the various branches of physical science. 3. That Professors and Local Teachers shall be appointed to give lectures on Science in the chief provincial towns, for whose use philosophical apparatus shall be provided; and that arrangements shall be made for testing by examination the proficiency of those who attend such lectures. 4. That the formation of Museums and Public Libraries in such towns, open to all classes, shall be encouraged and assisted in like manner as aid is now given to instruction in the principles of Art; that all imposts shall by degrees be abolished that impede the diffusion of scientific knowledge; and such donations of national publications be made as above mentioned. 5. That more encouragement shall be given, by fellowships, increased salaries to Professors, and other rewards, to the study of Physical Science. 6. That an alteration shall be made in the present system of bestowing pensions; some annuities in the nature of good-service pensions be granted; and additional aid be given to the prosecution, reduction, and publication of scientific researches. 7. That an appropriate building, in some central situation in London, shall be provided at the cost of the nation, in which the principal Scientific Societies may be located together. 8. That scientific offices shall be placed more nearly on a level in respect to salary, with such other civil appointments as are an object of ambition to highly educated men; that the officers themselves shall be emancipated from all such interference as is calculated to obstruct the zealous performance of their duties; and that new scientific offices shall be created in some cases in which they are required. 9. That facilities shall be given for transmitting and receiving scientific publications to and from our colonies and foreign parts. 10. That a Board of Science shall be constituted, composed partly of persons holding offices under the Crown, and partly of men of the highest eminence in science, which shall have the control and expenditure of the greater part at least of the public funds given for its advancement and encouragement, shall originate applications for pecuniary or other aid to science, and generally perform such functions as are above described, together with such others as Government or Parliament may think fit to impose upon it.

FLUID GUM BOTTLE.—A useful little contrivance for holding fluid gum, suitable for the studio of the specimen collector, or for the office of the merchant, has lately come into use, and we can recommend it for its convenience and economical value. Our engraving represents the one we have in use, on a scale of half the real size. It is of transparent glass, having an expanded base to give steadiness, whilst the neck on which the hollow cap fits is contracted to about three-eighths of an inch, this throat having a bent-over inner lip, somewhat like the old form of "exciseman's inkstand." It is this lip which forms the essential point of improvement, for on the gumming brush being drawn out charged with gum for use, the projecting lip catches the superfluous matter, and not only fits the brush for use by robbing it of the huge drop usually adhering to it, but returns the detached fluid direct to the reservoir. In this way the user has always a properly-loaded brush, whilst he cannot block up the bottle neck with the detached drops—a result which, with the ordinary gum-holder, is a most insufferable nuisance. The brush has a short thick stem, just large enough to give a fair grasp above the level of the bottle neck, and the cover cap, which is ground to fit the neck, is made with a hollow cone rising high enough to receive the projecting handle, and cover all up from dust and the influence of the atmosphere. This holder is obviously available for the retention of various fluid or semifluid matters, requiring to be used in small quantities at distant intervals.



BROWN'S PORTABLE WOOD-FRAMED TENT.—The ingenious dovetailing system of joining the component details of furniture, invented by Mr. A. D. Brown of Glasgow,* has now been applied by the patentee in the construction of tent framings. Instead of a mere strained bag of canvas, like the common tent, Mr. Brown proposes to give such structures all the stability of a bound building, and this he accomplishes with the aid of a light timber frame, put together by means of dovetail joints, in the same way that he makes chairs and tables. In the example which we have seen, the skeleton frame is of birch, 2½ inches by 1½, and is rectangular, 14 feet long by 12 feet wide, and 9 feet high. The entrance door is in the centre of the long front, giving admission into a central area of 10 feet square. The remaining space on each side of this area is occupied by twelve sleeping berths, six on each side, 6 feet by 2 feet 2 inches wide, and 2 feet between each in height. The whole frame can be packed within 18 cubic feet. The tent covering is made in the form of a complete canvas slip, to pass on from the top. It is probable that such a tent would be a useful thing for Crimean service, put together, as it is, entirely by dovetail connections, so that there are no loose parts to scatter about and take time to put up. In firmness, the structure is all that can be desired. It is easy to see that the covering may be made in various ways. Instead of canvas, the covering may be of prepared felt, nailed on, forming a light thatch.

STATISTICS OF PATENTS IN 1854–5.—We have now the means of seeing plainly the wonderful development of the inventive faculty of the times in which we live, aided, as it has been, by the legal changes of 1852. This insight arises from the new provision as to statistical tables, from which we find that the number of applications for provisional protection recorded within the year 1854 was 2,764; the number of patents passed thereon was 1,876; the number of specifications filed in pursuance thereof was 1,828; and the number of applications lapsed or forfeited, the applicants having neglected to proceed for their patents within the six months of provisional protection, was 888. The number of applications recorded within the first six months of the current year (1855) was 1,493, showing a probable increase as compared to the number of the year 1854. All the provisional, complete, and final specifications filed in the office upon the patents sealed under the act, from the 1st October, 1852, to the 30th June, 1855, 4,897 in number, have been printed and published, with lithographic outline copies of the drawings accompanying the same. The prints are sold to the public at the Patent Office, and each specification is printed and published within three weeks of its deposit in the office. The provisional specifications filed in the office within the same period, and lapsed and forfeited, 2,290 in number, have also been printed and published. A list of the publications made by the commissioners since October, 1852, follows. All are in imperial 8vo., and the specifications alone form 170 volumes of letterpress, and as many volumes of lithographic drawings. The old specifications number 12,977; of these, 1,526 have already been printed; and as it is proposed to print at the rate of 2,000 in each succeeding year, the work will be completed in six years or thereabouts, and the annual expenditure of £18,000 on this account will then cease. The contract prices for lithographic printing having been lowered, and the number of copies now printed of each specification being 250 instead of 500 as formerly, the expenditure in respect of printing has been considerably reduced. The work now in progress in the printing of the old specifications, is the whole subject of steam-engines, those applicable to the propulsion of vessels having been already printed; when this subject shall have been completed, it is intended to commence the subject of the machinery for the manufacture of textile fabrics. The commissioners have transmitted the prints of specifications, indexes of patents, and all other papers printed by them, to the chief magistrates and corporations of the principal towns within the United Kingdom, to be placed in such public free libraries as may now exist, or may hereafter be formed for the purpose, upon certain conditions. The prints have been received by the several towns subject to the above-mentioned conditions, and in many of the large towns the gift has laid the foundation of free libraries, no such libraries having previously existed—the prints in continuation will be forwarded every succeeding Monday. The commissioners have established a public free library of research within the Patent Office, in Southampton Buildings. Convenient rooms are provided for the purpose, and the library is open to the public from ten to four every day.

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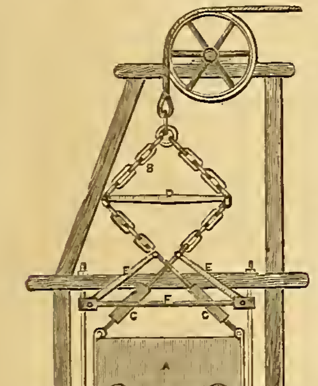
* Page 140, Vol. VI., *Practical Mechanic's Journal.*

Smith's Miner's Safety Cage.—That veteran wire-rope maker, Mr. Andrew Smith, has recently devised and patented a happy and ingenious application of his staple commodity, in reference to the safety apparatus of the miner's lifting cage. Our sketch represents this novelty in its effects under the two conditions of a solid and broken winding rope. The ordinary winding rope is attached to the cage, A, by two chains, B, shackled to the two cross connecting elastic lanyards, C, the ends of which are fastened to the opposite sides of the cage. A stretcher, D, is shackled to the chains so as to keep the latter distended, to form a right angle with the eccentric jam levers, E; the external ends of these levers are jointed to a cross, F, of the cage. The two ends of this cross bar act as guide eyes for embracing the vertical lengths of wire rope, G, extending from top to bottom on each side of the main shaft; the ends of the levers, E, being hinged to the bar in such manner as to leave the guide ropes, G, clear, when the parts are in the position shown in the upper portion of our sketch. Should, however, the winding rope break, the elastic contraction of the lanyards, C, draws down the levers, E, to a horizontal position, causing the eccentric jointed ends of these levers to jam the guide ropes, G, in the ends of the cross bar, F, and thus sustain the cage. The frightful occurrence of a rope's failure is shown in the lower part of the shaft; the cage being entirely supported by the nip of the levers, E, upon the guide ropes. The action of this contrivance must be very certain, and the detaining hold of the safety nippers must be equally secure. Rods of iron, or wooden bars, may be used instead of the guide ropes, G, but the wire rope is to be recommended for more reasons than one. If our colliery owners could be induced to adopt a safety contrivance of this kind, with the additional apparatus for preventing overwinding, we should hear little about cage accidents. The miner has indeed plenty of unrelenting underground enemies, without leaving him at the mercy of treacherous ropes.



Parker and Thompson's Carpenter's Brace.—A new design for a carpenter's and joiner's brace for hand-boring, has just been introduced by Messrs. Parker & Thompson, of Rockingham Street, Sheffield, of a sufficiently good character to recommend itself to all operative artisans whose avocations demand such tools. This tool, besides being of a much better and more elegant pattern than the old tool, is fitted with a strong circular pad, so as to be better to handle when in motion. Its revolving handle allows the user to take a firm grasp, so as to increase the boring power, whilst all friction in the hand is avoided. Its improved head, too, is better adapted to the hand, and contains a superior fastening, doing away with all nuts and washers, whilst a regulator is introduced to cause the head to turn truly, and with steadiness, even when the working parts are severely worn. On the whole, this tool is a great improvement upon the old model.

The British Association at Glasgow, 1855.—As already announced by us in March last, the British Association for the Advancement of Science meets this year at Glasgow, on the 12th of this month. Everything augurs well for a brilliant gathering, as acceptances of invitations have flowed in from a large number of men of note. Dr. Scoresby has announced four papers—one of them on the magnetism of iron ships, a subject to which he has paid a large amount of attention. Dr. Playfair, the president of the Chemical section, intends to devote a day to each of the following subjects, viz.:—1. Manufacturing Chemistry; 2. Agricultural Chemistry; 3. Recent views in Theoretical Chemistry regarding constitutions. The subject of the adulteration of food and medicines is likewise expected to be discussed. Colonel Rawlinson will also add to his already well-known labours on the monumental inscriptions of Assyria; and Dr. Carpenter has something to say on natural history;—but we cannot particularise the details of the great scientific treat which thus awaits our Scottish industrial centre. The City hall, Trades' hall, Merchants' hall, and the hall of the Philosophical Society, together with a portion of a large warehouse recently built by Messrs. Wylie and Lochhead, have been placed at the disposal of the Association gratuitously.

The chief excursion decided on, is one to the romantic island of Arran, in the Frith of Clyde—a journey which, in itself, ought to be worthy the consideration of distant residents. But the fact that Glasgow is now the focus of so much that is interesting in mechanical and chemical pursuits, must be an attraction sufficient to draw a goodly crowd of visitors.

Nibbs' Oxydate Condensing Oil-Lamps.—We first of all drew attention to Mr. Nibbs' ingenious invention, as far back as the early part of our third volume, page 85. Since this date the inventor has made numerous improvements upon his original ideas, and we have now had a good opportunity of testing his latest modifications in actual practice. This we have done with two distinct classes—a twenty shilling drawing-room lamp, with opal pillar and oil vase, and ornamental base and capital of brass, and a five shilling "Crimean army lantern." Both are of the simplest mechanical construction, and both have fully confirmed our expectations of their performance. In the more elaborate example, the oil—in our instance Colza—is contained in a spreading opal reservoir, surmounting the capital of the pillar, this reservoir forming the seat for carrying the plate of the wick tube. The wick tube is flat, holding a flat-plaited wick, an inch wide. One side of the wick tube is perforated, for the admission of the forked end of an adjusting lever, which is loosely set upon a pin on the wick-tube seat, and conveniently disposed for the hand in setting the wick up or down in trimming. The chimney glass carrier is hinged to the wick-tube seat on one side, and it carries at its centre a hollow flattened cone of thin metal, acting as a "condensing cap" for directing atmospheric air forcibly against the flame. Before lighting, the wick is cut to a slight convexity, its upper end being but very slightly above the level of the wick tube. When lighted, the hinged condensing cap is shut down over the incipient flame, completely enveloping the wick—which is considerably below the upper edge of the cap—as well as the lower part of the flame, and causing a broad thin flame to spring up through the narrow orifice of the condensing cap when the chimney is put on. The light is beautifully clear and steady, and any one will easily discover the system of adjustment for it. The lantern is similar in its details, but possesses no condensing cap. The oil reservoir is in a base chamber, from which a pair of slender rods spring up to carry a metal chimney, over which the spherical glass globe is passed. This light is extremely manageable and convenient, but its great merit is its extreme cheapness. Large numbers of the lanterns have been made for government use in the Crimea. The productions of Mr. Nibbs' Bakewell Works, are indeed to be remarked for their peculiar cheapness. A "brass cottage lamp, with half-inch wick, to burn ten hours," can be sold for a shilling. The modern march of economical production can present few rivals to this.

Progress of Invention in America.—We present elsewhere a digest of what has been doing in this country in matters of scientific invention during the past year. We are now enabled to detail still more forcibly what inventors in the United States have been about ever since the commencement of such grants, giving to each class its real quantity of separate schemes.

Air-engines, of which so much has been heard, and by which nothing useful whatever has been done, are represented in America by twenty-one distinct patents. It is hardly necessary to record, in permanent print, that, regardless of the brilliant promises of Ericsson and others, who have tried their hands at this sort of work, not one single contrivance of the air-engine genus is at present at work. "Baby jumpers" have been less assuming and more successful, for these machines have met with some adoption, whilst they are represented by but one patent.

Steam-boilers, an old subject, show 148 patents; but explosions do occur, even in America, and even there the economy of fuel is still far from its possible limits.

The india-rubber manufacture, a modern branch of industry, already numbers forty-two patents, many of them most successful things.

Sewing machines, which are still younger, the oldest dating but nine years back, claim for themselves sixty patents.

Water wheels, which are antique enough, have afforded room for 327 schemes; but washing machines, of by no means so old a date, show 309.

The Americans, by reason of their dear labour in drudging operations, are particularly rich in agricultural contrivances. Grain and grass harvesters have been patented under 111 different forms; ploughs have had 372 patents; straw-cutters, 153; smut machines, 140; winnowing machines, 163; and thrashing machines, no fewer than 378. What a contrast to our slow progress in this department! The sluggish and ineffectual hand of the labourer is still by far too much relied on in Great Britain. The pittance for which an English agriculturer labourer can be obtained, retards the progress of agricultural mechanism, just so much as the costliness of the American workman accelerates it—an excellent sermon upon the maxim, that "necessity is the mother of invention."

America is the land of stoves—hence we find that 682 patents and 478 designs have there sprung into existence. Truly enough, the patent lists of a nation are a fair index of its progress.

Dinner to J. E. M'Connell, Esq.—We must afford space to chronicle that a dinner was given on the 15th ult., at the Star and Garter, Richmond, in honour of the efficient engineer-in-chief to the London and North-Western Railway Company. Some of his many friends, conceiving that the tact and ability displayed by Mr. M'Connell on the occasion of the quarrel between the engine-drivers of the London and North-Western Railway Company and their employers was such as deserved some sort of public acknowledgment, arranged the dinner in question. Twenty-seven gentlemen connected with the leading lines of the kingdom met Mr. M'Connell on this occasion, Mr. Watkins of the Manchester, Sheffield, and Lincolnshire Railway filling the chair, the duties of which position he performed to the entire satisfaction of all present. The usual loyal toasts having been gone through, the health of Mr. M'Connell was drunk, and in the course of his able speech, the chairman said he considered that the arrangement of the strike was attended with circumstances that reflected great honour upon their guest, and that he laid not only his own Railway Company, but all other Railway Companies, under an obligation to him.

The Royal Agricultural Society at Carlisle.—The "merrie Carlisle" of ancient days has had its present dullness enlivened during the past month by the Royal Agricultural Society of England, and the gathering has turned out to be one of the most interesting that has occurred since the foundation of the Society.

A partial opening of the show-ground took place on the 19th of July, public admission being confined, however, to the trial-yard of machinery. The enclosure measured fifteen acres. This space is separated into two divisions, the larger of which was appropriated to live stock, implements, and agricultural seeds, the other to the steam-engines, stationary and locomotive, and the more complicated pieces of machinery which require steam power to put them in operation. The former compartment contained no less than thirty-six wooden sheds or booths, running across the ground and parallel to each other. Twenty of these sheds were appropriated to live stock, including horses, cattle, and sheep, fourteen to agricultural implements, and two to agricultural seeds and poultry. Altogether, the total amount of shedding and fencing exceeded two miles.

The show-ground contained the dining pavilion, a crystal palace kind of structure, capable of holding 800 diners.

Carlisle subscribed £1400, and the Society itself made up this sum to £2000, all for prizes, which the sequel of the show has proved to be well deserved. This praise may be bestowed on all the sections of the show—horses, cattle, sheep, and implements; but our business is with the last. The trial-field, where actual work was employed to test the status of the mechanism submitted to the farmer, was at Drawdykes, two miles from the great show-yard. Mr. J. V. Gooch, the railway engineer, Mr. W. Owen of Rotherham, and Mr. Amos, the Society's engineer, were engaged in settling the respective merits of the rival steam-engines; and Messrs. Huskisson, Grainger, Read, and Scott decided as to the implements.

The entries for portable power-engines were (1) Messrs. Tuxford of Boston, Lincolnshire; (2) Clayton, Lincoln; (3) Barrett, Reading; (4) Hornsby, Grantham; (5) Ransomes, Ipswich; (6) Garrett, Saxmundham; (7) Crosskill, Beverley; (8) Lee, Walsall; whose engines were respectively (1) 8-horse power; (2) 8· (3) 6; (4) 8; (5) 7; (6) 7; (7) 6; (8) 7; and prices (1) £250; (2) £260; (3) £215; (4) £255; (5) £230; (6) £235; (7) £220; (8) £180. The getting up the steam of the several engines involved a consumption, as under, of—

	Wood. lb.	Coals. lb.	Time. min.
1	24	28	66
2	24	18¼	44½
3	18	18¼	65
4	24	34½	39
5	21	26¾	55¼
6	21	26	44
7	18	30	66
8	21	35	43½

The quantity of coal consumed (per lb.) per horse per hour was (1) 3·698; (2) 4·054; (3) 4·421; (4) 4·839; (5) 5·054; (6) 5·606; (7) 8·080; (8) 10·00.

Messrs. Barrett, Exall, and Andrewes, and Messrs. Ransomes and Sims were close upon the leading engines, Messrs. Clayton and Shuttleworth coming second.

At the close of the trial of the locomotive farm-engines, Mr. Boydell's "steam horse," or "traction engine," was put upon the brake in order to test its power. At a pressure of 53 lb., the dynamometer showed that the engine had a power of 14⅓ horses. There is nothing new in this scheme, but the precise arrangement of the details. The engine forms its own railway as it goes over the land, thus overcoming one great difficulty in the way of steam locomotion upon the bare earth. The "portable railway," which the engine wheels carry with them, consists of a series of short lengths of rail on a broad sole. These rails revolve with the wheel, and outside its periphery, the arrangement being that each wheel has always a short piece of rail in front of it ready for the wheel to roll upon as on a permanent line, and after serving this purpose, the rail is lifted and passed forward, and passed again to the front at each revolution. It ran itself from the show-yard, over some difficult and steep road, to the trial-field, and there went through the operations of ploughing, scarifying, and harrowing with very fair success. Its performances seemed to stagger some of the old sticklers for things as they are, giving a pretty broad hint that steam was insensibly coming closer to the farmer.

There were seven fixed engines in the yard, all, with one exception, of eight-horse power, exhibited by Messrs. Barrett, Exall, and Andrewes, of Reading; Clayton, Shuttleworth, and Co., Lincoln; Wm. Dray and Co., London; Ransomes and Sims, Ipswich; J. Gray and Co., Uddingstone, Glasgow; Smith and Co., Glasgow; and Tuxford and Sons, Buxton.

The trial of the fixed engines was conducted in a somewhat imperfect manner. The peculiar quality of coal supplied is such as to render it impossible to generate steam sufficient for the satisfactory working of the engines, which were several times brought to a stand-still in consequence. Under these circumstances the result was necessarily an imperfect one. With both the fixed and the portable engines, the usual method observed by the Society was adopted in the trials—that of supplying to each engine 14 lb. of coal for each horse-power, with which they were to effect as large an amount of work as the capacity and the economical arrangement of the machine would permit upon the dynamometer supplied by the Society.

The following prize list exhibits the final results arrived at with both classes of engines:—

For the best portable steam-engine, not exceeding 8-horse power, applicable to thrashing or other agricultural purposes—£20, to Tuxford and Sons.

For the second best ditto—£10, to Clayton, Shuttleworth, and Co.

For the best fixed steam-engine, not exceeding 8-horse power, applicable to thrashing or other agricultural purposes—£20, to Ransomes and Sims.

For the second best ditto—£10, to Barrett, Exall, and Andrewes.

Mr. Nicholson of Newark exhibited a one-horse portable engine, set on a single pair of wheels, and fitted with a pole for being pushed about. Its cheapness and great portability were much remarked.

The entries of thrashing machines were by Messrs. Garrett, Barrett, and Co., Humphreys, Holmes, Clayton, Tuxford, Ransomes, and Hornsby. Each machine was intended to thrash 150 sheaves on trial. In one amount of time the maximum power consumed to complete the work was 150 lb.; the minimum, 90 lb.

The result here stood thus in the prize list:—

For the best portable thrashing machine, not exceeding 6-horse power, for larger occupations—£10, to Ransomes and Sims.

For the best portable thrashing machine, not exceeding 8-horse power, with shaker, riddle, and winnower, that will best prepare the corn for the finishing dressing machine, to be driven by steam—£20, to R. Hornsby and Son.

In the power-machine chaff-cutters, &c., the following parties competed:—Messrs. Barrett and Hall, Williams, Dray and Co., Richard and Chandler, Smith and Ashby, Cornes, Carson, Turner, Ransomes and Sims, Garrett and Son. The greatest quantity of chaff cut by one machine was 1485 lb. within the hour; the least, 600 lb., showing a considerable variation. The minimum amount of power required for cutting 11 lb. of chaff, lifting one foot, was 1·267 lb., the maximum 2·868 lb.

In the hand-power chaff-cutters, the following parties competed:—Messrs. Crosskill, Garrett and Son, Williams, Hill and Smith, Smith and Ashby, Richmond and Chandler, Cornes, Carson, Ransomes and Sims. The capabilities of these implements varied—the greatest amount of chaff cut within the hour being 210 lb.; the least, 90 lb.; the minimum power required for cutting 1 lb. being 1·284 lb.; the maximum, 3·310 lb.

The prizes were thus assigned:—

For the best chaff-cutter, to be worked by horse or steam power—£5, to James Cornes.

For the best chaff-cutter, to be worked by hand power—£3, to Richmond and Chandler.

Mr. B. Samuelson of Manbury carried off the £3 prize for the best turnip-cutter; and Mr. F. Phillips was similarly fortunate with his pulping machine.

Messrs. Turner of Ipswich gained the £5 prize for their linseed and corn-crusher; and Messrs. Garrett a similar award for their oil-cake breaker. The "best grinding mill for breaking agricultural produce into meal" was that of Messrs. Clayton, Shuttleworth, and Co.; Mr. Crosskill displayed the "best bone-mill;" and Messrs. Burgess and Key stood, as usual, at the head of "churns," with their American importation. The remainder of the implement prizes are comprehended in the following list:—

For the plough best adapted for general purposes—£5, to Ransomes and Sims.

For the plough best adapted for ploughing more than nine inches deep—£5, to Ransomes and Sims.

For the best machine for making draining tiles or pipes for agricultural purposes—£5, to John Whitehead.

For the best cultivator, grubber, and scarifier—£5, to Richard Coleman.

For the best drill for general purposes—£10, to R. Garrett and Son.

For the best corn and seed drill—£10, to R. Hornsby and Son.

For the best and most economical corn drill for small occupations—£5, to R. Hornsby and Son.

For the best and most economical small-occupation seed and manure drill for flat or ridged work—£5, to Holmes and Son.

For the best turnip drill on the flat, with manure—£5, to R. Garret and Son.

For the best turnip drill on the ridge, with manure—£5, to R. Hornsby and Son.

For the best liquid manure or water drill—£10, to R. and J. Reeves.

For the best manure distributer—£10, to R. Garret and Son.

For the best horse hoe on the flat—£5, to R. Garrett and Son.

For the best horse hoe for setting out or thinning turnips—£5, to R. Garrett and Son.

Messrs. Porter, Hinde, and Porter, of Carlisle, had a brick machine which produced 18,000 bricks in an hour. The machine effects the two processes, almost simultaneously, of "pugging" and moulding the clay. The pug-mill is horizontal, having two shafts, on which are placed two cylinders, with a series of knives cast on each. It is fed with tempered clay, which it thoroughly commingles and propels by means of the splay given by the knives to the rollers, which are supplied through a chamber at the end of the pug-mill. These rollers force the clay through a die of hard wood or gun metal of suitable dimensions to form the sides of the bricks. As the clay is thus propelled in a solid and consistent body, it moves upon small rollers until it comes within range of the cutting apparatus, which is a contrivance of six wires attached to a frame sliding upon friction rollers. This frame is moved suddenly backwards and forwards by the hand, separating the clay into five well-formed bricks at each stroke. The bricks are cut in the direction of their bed, so that the four sides are preserved smooth, while the top and bottom are slightly roughened, an effect which, with the perforation of the centre, secures the proper adhesion of the mortar, and consequent safety in building.

The proceedings were enlivened by an agricultural lecture by Mr. Mechi, who, as usual, was listened to by a large audience, anxious to learn the latest news from the Tiptree farm. Since his appearance at Carlisle, Mr. Mechi has had his annual gathering on his renowned estate, where he seemed to have collected all the notables of the day who take an interest in matters of the field. The gradual and sure progress which he has made upon his ungrateful soil were more marked than ever. Calculations were made that his oats would bring from twelve to fifteen quarters per acre, and his wheat from five to six. His clear return for last year he sets down at £700; and the superior economy of management everywhere visible throughout the farm, is some indication that he has attained a far more reliable position than formerly—for extravagance in farming can have but one end.

A steam drawing machine by Lord Dnndonald, a Belgian steam cultivator, and an American winnower, were amongst the mechanical attractions of the day.

Chelmsford is to be the scene of the Society's operations next year.

War Inventions.—It was stated by a member of the Government, in the House of Commons, a short time ago, that 974 inventions relating to belligerent implements and schemes had been brought before the select committee of the Board of Ordnance. Some of the more important ones had been carried into effect, 696 had been rejected, and the remainder were then under consideration.

New Munitions of War.—During the past month, the Chelsea Hospital grounds have been the scene of some important experiments with a new war appliance, invented by Colonel Disney. This is a shell fitted with an internal metal cylinder, containing a bursting charge of powder, the rest of the shell's capacity being occupied by a highly combustible fluid, which, when exposed to the atmosphere, ignites everything near it. The contained fluid has no effect upon the shell's surface, and it is not explosive in itself. The burning power of this peculiar shell is stated to be very remarkable, and for this reason it promises to be a valuable aid to the military man. This contrivance reminds us of a "Self-heating shot" for war purposes, invented by Mr. James Scouller, an ingenious Glasgow mechanic. We described this curious missile at page 70 of our second volume, a reference to which will repay the interested reader in these stirring times.

Messrs. Losh, Wilson, & Bell, of Newcastle, have finished a lot of shells for the Turkish Government, and are now busy upon 35,000 shells, from 8 to 13 inches, for our own war purposes. Mr. Benson's new shell, so successful in its late trials, is also being made by this firm. Mr. Andrew Barclay, the ingenious mechanical engineer of Kilmarnock, whose works have often appeared in the *Practical Mechanic's Journal*, has undertaken the manufacture of 13-inch mortars for the new gun-boats. These widely-spread commissions are good evidence of the energetic measures which the Government has now adopted in carrying out their present great war measures.

The recent commentaries upon the sluggish spirit of the Birmingham gunsmiths have necessarily created some sensation in the great Warwickshire workshop; and Mr. J. Goodman, the chairman of the small arms trade, has spoken out as to what the town has done, and can do. He states that, from the beginning of March to the end of July, Birmingham has contributed 30,000 rifles to the government stores. The recent deliveries have been at the rate of 2000 rifles per week. For some time the gunmakers have received their materials at the rate of 3000 per week, and very shortly the large number of 4000 finished guns is promised. No fewer than twenty different firms are engaged in working up the materials supplied by government. Mr. Goodman endeavours to rebut the charge of apathy lately brought against the Birmingham mechanics, remarking that "the Manchester men, in the small attempt they have made to aid in the supply of materials for rifles, thought they could dispense with the hand labour. If I am not wrong, they have, at some pecuniary cost to themselves, discovered that they have committed a mistake. When I see our town-hall transferred to their Market-street, or the ring of the anvil in our streets exchanged for the sound of the spindle, I will then begin to believe in the possibility of Manchester making guns, or teaching Birmingham how to make them."

A Mr. Bashley Britten has lately tried some experiments at Shoehnryness, under the superintendence of Colonel Mitchell, with some newly invented shells; and his results, as officially published, show that, with little more than half the regulation charge of powder, the improved missiles have a range of 1000 yards more than the solid shot of the service with full charge, whilst the aim was vastly superior. With a 14½ lb. shot, and 1¾ lb. of powder, the extreme range was 3,800 yards. A 9 lb. solid shot, with 3 lbs. of powder, got an extreme range of only 2,850 yards.

Marine Memoranda.—The launch of the *Marlborough* screw steamship at Portsmouth, an event long looked forward to with more than ordinary interest, was quite shorn of its magnificence, and nearly turned into a disaster, by a very strange incident. With her Majesty, Prince Albert, and the Court as spectators, such an event ought to have gone off with superior effect. But the launch was really no launch at all, and the enormous vessel only reached the water after being hauled off the ways by tugging steamers in a most ignoble manner. The Queen herself honoured the occasion by christening the ship, and dashed the flower-wreathed bottle against her bow in true conventional fashion. The bottle was shivered exactly at twelve o'clock, but it was not until twenty-five minutes past twelve that the ship began to move towards the water. To the great astonishment and chagrin of everybody present, and especially to the dockyard officers, the *Marlborough*, christened and salvoed though she was, hesitated when she got two-thirds of her length out of the building shed, and then stuck fast. Finding that there was no chance of a launch, the Queen retired, without seeing the completion of the transfer from land to sea; and it was not until midnight that the exertions of 2000 men and three steamers got the vessel off. The failure of the piling of the ways is assigned as the cause of this untoward accident. We append a tabulated statement of the *Marlborough's* principal details:—

	Feet.	Inches.
Length between the perpendiculars,	215	6
Length of keel for tonnage,	206	3⅞
Breadth extreme,	61	2½
Breadth for tonnage,	60	4½
Breadth moulded,	59	6½
Depth in hold,	25	10
Burden in tons, 4000 36·94.		
Load draught of water forward,	25	0
Do. do. aft,	26	0
Height of taffrail above lead-water line,	39	10
Height of main truck,	213	4

DEAD WEIGHT.

Weight of mainmast,	23 tons.
Weight of mainyard,	6 "
Length of mainyard,	111 feet.
Anchors,	23 tons.
Rigging,	93 "
Sails (square feet, 38,974),	15 "
Guns and carriages,	369 "
Shot,	170 "
Powder.	64 "
Machinery, consisting of two direct-acting engines, six boilers, and machinery,	600 "
Weight of water in boilers,	100 "
Power of engines and boilers,	800 horses.

She is intended to carry the following formidable armament:—

	Number of Guns.	Calibre.	Weight.	Length.
Gundeck,............	10	... 8 inch	... 65 cwt.	9 feet.
Do, ...	26	... 32 prs.	... 56 "	9 feet 6 inches.
Middledeck,.........	30	... 32 "	... 56 "	9 " 6 "
Do., ...	6	... 8 inch	... 65 "	9 "
Maindeck, ...	38	... 32 prs.	... 42 "	8 "
Quarterdeck, ...	20	... 32 "	... 25 "	6 "
Forecastle, ...	1	... 68 "	... 95 "	10 " (pivot).
Total,.............	131			

A new *Rob Roy* iron screw-steamer has just been placed on Loch Katrine, as a successor to the old paddle-boat of the same name, now superannuated, having seen ten years' service. She is the production of Mr. Alexander Denny of Dumbarton. Her length is 100 feet, with 14 feet beam, and her power is derived from a pair of small high-pressure engines of 30 horse power, driving a screw 4 feet 6 inches in diameter, and 11 feet pitch. She has a good saloon, 38 feet long, lighted by 24 windows, so that the passengers will always find themselves well guarded from the too common wet of the Scottish climate. The comparatively inaccessible portion of Loch Katrine, rendered it necessary to adopt a novel system of transport for the hull of this vessel. The plates of which she is composed were originally temporarily fitted together in the builder's yard at Dumbarton, and they were then taken down, and conveyed piecemeal up Lochlomond to Inversnaid, and thence, by the Duke of Montrose's new road, to Stronaclachan, at the head of Loch Katrine. Here the plates were again put together, and finally riveted and launched.

Mr. Vanderbilt, whose intentions as regards Atlantic steaming we some time ago announced, has now arranged with Messrs. Croskey & Co., New York, for the establishment of a line of first-class paddle-steamers between New York and Southampton. These steamers are to load at Havre, calling, however, at Southampton. Mr. Vanderhilt's own vessel, the *North Star*, of 2,500 tons burden and 800 horse power, and the *Ariel*, of 2,350 tons burden and 750 horse power, are to go upon the line at once. The departures are to take place tri-weekly, commencing with the *North Star*. Other ships are building for the route, and a fortnightly line will eventually be formed. Among other ships which Commodore Vanderbilt is preparing for this business, is a monster steamship of 4000 tons register, intended to be at once the largest and swiftest of the Atlantic steamers. Commodore Vanderbilt is running his ships entirely unassisted by any government grant or subvention whatever, relying exclusively upon the revenue to be derived from the traffic for his remuneration.

The recent fine execution of the *Lady Nancy* raft at Taganrog, in contradistinction to that of our deep draught ships of the line, has done much to show how far our immense naval structures are surpassed under certain circumstances of action. Striking them whilst the iron is hot, Mr. Daft, an inventive engineer of some standing, has come forward with a plan of a vast steam raft for naval war purposes. It is proposed that the raft should be composed of 300 pontoon-shaped iron boats, nearly all 100 feet long by 10 feet wide and 7 deep, having semicircular bottoms and sides, and flanged on the edges or gunwales. With fifteen of these placed longitudinally, the length of the raft would be 1,500 feet, and 20 in breadth, with 5 feet spans between each, would give a width of 300 feet. Thus the deck area would be little short of ten acres. The pontoon boats it is proposed to brace together by diagonal tie bars, while the deck would be formed of timber six inches thick, firmly bolted to the flanges, and having hatchways into each of the boats, which would thus furnish the accommodation and stowage required for passengers and goods. Bulwarks are contemplated, 12 feet 6 inches high, and consisting of hollow iron stanchions, 33 feet 4 inches apart from each other, with iron compartments between, made to open from the top on centres. The whole mass would thus be braced together as if it were one huge solid substance, 1,500 feet long, 300 feet wide, and 20 feet thick. It is proposed by the projector of this new leviathan to propel her by twenty-two steam-engines of at least 200 horse power each, eleven on each side of the raft, with paddles and screws affixed alternately. This vessel will carry a freight of 20,000 tons, having a speed of 15 knots, and drawing but 3 feet 6 inches of water.

The Peninsular and Oriental Company have just started a new screw steamship, the *Ava*, which, at the Stokes bay Mill, performed an average of $13\frac{3}{4}$ miles per hour. She has since left Southampton for Alexandria.

Great things are spoken of Her Majesty's new steam yacht *Victoria and Albert*; whilst she is a triumph of beauty, finish, and sound internal comfort, she performs her average of 18 knots per hour, with all the quiet ease and dignity befitting the ocean palace of an island queen. Her royal mistress delights as much in her as a residence, as for her sailing qualities.

Following out the floating factory system, started some time ago with the flour and biscuit factory ship sent out to the scene of war, the Government have commissioned Messrs. Smith, of St. Peter's Dock, Newcastle, to build a steamer for factory engineering purposes. This vessel, just completed, contains a large workshop between decks, fitted with the best tools obtainable in this country, consisting of drilling, punching, shearing, shaping, and slotting apparatus, and two circular saw benches, besides smiths' forges, with fan-blasts, and a cupola for iron and brass casting. The ship's engine and a ten-horse portable engine supply the necessary power for driving the tools. Colonel Tulloch and Mr. Anderson, of the Arsenal, Woolwich, aided by Capt. Collinson, have superintended the fitting up, which is of the most complete kind.

MESSRS. ROBB & HILL'S PATENT MAST.—The first vessel to which this invention has been applied, has just been finished by Messrs. Laurence Hill & Co. of Port-Glasgow. She is an iron screw steamer, of about 600 tons O. M., for the African Steam Ship Company, and has her mainmast, from step to several feet above upper deck, of a strong iron tube, into which is fitted the usual wooden mast; by this means, should the mast break, or be cut away, a new one can easily be fitted in without disturbing the cargo. This vessel has also her keel built on a plan patented by builders some time ago; having, instead of a solid forged bar, several plates securely riveted together, thereby giving a great increase of strength at less cost.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded March 31.

723. William H. Balmain, St. Helens, Lancashire—Improved methods of, or processes for, recovering oxide of manganese after it has been used in the manufacture of chlorine.

Recorded May 4.

997. Jean Pechgris de Frontin, Agen, France, and 32 Essex-street, Strand—Invention for the use of a new material in the manufacture of paper and pasteboard.

Recorded June 22.

1433. Simon E. G. Simon, Paris, and 4 South-street, Finsbury—Invention of the use of a new material in the manufacture of paper.

Recorded June 28.

1474. Christopher J. Symons, Hereford—Certain improvements in steam-engines.

Recorded June 29.

1481. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and Paris—Improvements in axle-boxes or plummer blocks.—(Communication.)
1482. Claude A. Busson, Paris—An improved mode of constructing and fixing the teeth of toothed cylinders employed in the treatment of textile or fibrous materials.
1483. Edward J. Hughes, Manchester—An improved method of concentrating the colouring matter of madder, munjeet, spent madder, or any preparations thereof.
1484. Jean Baptiste de Lorenzi, Paris, and 4 South-street, Finsbury—Certain improvements in the construction of organs.
1485. Henri Dembinski, Paris—Improvements in the process and apparatus for generating steam without combustible matter, except in accidental cases.
1486. Joseph Eccles, Blackburn—Improvements in the manufacture of bricks, tiles, and other articles made of plastic materials, and in machinery and arrangements or apparatus to be used for the purpose.
1487. John Broadbent and Stanley P. Youle, Manchester—Improvements in machinery or apparatus for cutting out the gores of umbrellas and parasols, which said improvements are also applicable to cutting out forms or shapes for other purposes.
1488. William Heaps, Forlon, Lancashire—Improvements in machinery or apparatus for working or cultivating land.
1489. John Weems, Johnstone—Improvements in drying grain and other substances.

Recorded June 30.

1490. William Woodcock, Hulme, Manchester—Improvements in machinery for making bricks, and other articles of plastic materials.
1491. Thomas Barling, Weymouth—Improvements in steam-engine boiler and other furnaces.
1492. William Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture or production of manures.—(Communication.)
1493. John Birch, Bradford—Improvements in the manufacture of iron.

Recorded July 2.

1494. William H. Tooth, 4 South-street, Southwark—Certain improvements in the machinery for, and in the manufacture of, earthenware and plastic articles, and in the preparation of clays and other materials.
1495. Joseph A. Mignon, Paris—Improvements in maps, charts, plans, tables, &c., of great dimensions, to render them more portable and useful.
1496. Francis Lycett, Wood-street—An improved glove, together with the means of manufacturing the same.—(Communication.)
1497. William Knapton, York—Improvements in furnaces for effecting the consumption of smoke.

Recorded July 3.

1498. William Hammant, 1 Standfield-street, Stepney—Invention of a new apparatus for condensing smoke.
1499. Robert Muckelt, Salford—Improvements in machinery for etching or engraving designs on cylindrical or other surfaces.

Recorded July 4.

1500. George Guillaume, 81 Marland place, Southampton—Certain improvements in machinery for communicating power to the wheel or axle of steam or other engines, or for carriages to be propelled by hand or foot.
1501. Georges A. Tabourin, Lyons, France—A new system of metallic arch, proper for the construction of bridges, arcades, vaults, roofs, and all other such purposes.
1502. Richard Tidmarsh, 23 Foxley-road, Camberwell New-road—An improved apparatus for lubricating metallic and other surfaces when in motion.
1503. William Clay, Liverpool—An improved mode of manufacturing forged iron.
1504. Charles Hide, Worthing, Sussex—Improvements in connecting earthenware pipes or tubes.
1505. John Inglis and Archibald Cowie, Glasgow—Improvements in moulding or shaping metals.

Recorded July 5.

1506. Samuel G. Flagg, 17 Cornhill—An improved folding boat.—(Communication.)
1507. James Connor, Coventry—Improvements in apparatus for communicating between the engine drivers and the guards of railway trains.
1508. William Gerhardi, Manchester—Improvements in safety valves and apparatus for regulating the pressure of steam and the quantity of water in steam boilers.
1509. Samuel Oddy, Salford—Improvements in constructing and lubricating the bearings of mule spindles.
1510. Joshua Horton and Thomas Horton, Birmingham—A new or improved manufacture of paper, pasteboard, and pulp.
1511. James Howard, Bedford—Improvements in the construction of ploughs.
1512. Thomas Felton, Edgbaston-street, Birmingham—Improvements in glass reflectors for gas and other artificial lights.
1513. Richard A. Brooman, 166 Fleet-street—Improvements in the manufacture of figured net and other like open fabrics.—(Communication.)

Recorded July 6.

1514. Jacob V. Asbury, Enfield—Improvements in apparatus for neutralizing the effect of collision or impaction in railway trains, stations, and other similar situations.
1515. James Bullough, Accrington, Robert Willan, Blackburn, and John Walmsley, Accrington—Improvements in machinery or apparatus for warping by power.
1516. Julien A. Bellay, Paris—Improvements in manufacturing articles of earthenware and china.
1517. William Balk, Ipswich—Improvements in the construction and combination of parts of portable steam engines.
1518. Anguish H. A. Durant, Salop—An improvement in extracting castor oil.
1519. William R. Morris and William Morris, Deptford, and Richard Chrimes and George Eskholme, Rotherham—Improvements in the construction and arrangement and apparatus for preventing the waste of water from service pipes or cisterns.
1520. James Beckett and William Seed, Preston—Improvements in machinery for spinning cotton and other fibrous substances.
1521. William Boycs, Preston—Improvements in looms for weaving.

Recorded July 7.

1522. John Gedge, Wellington-street South, Strand—Improvements in aerated waters.—(Communication.)
1524. Edward V. Neale, 4 Russell-place, Fitzroy-square—Improvements in the application of vitreous substances to the manufacture of labels, tablets, finger-plates, tiles, and other architectural decorations.
1525. John Pym, Stanley-street, Pimlico—A new combination of materials suitable for building purposes.
1526. Edwin Yates, Birmingham—A new or improved dinner and dessert fork.
1527. Christian F. Werner and Loudovicus Piglbein, Hamburgh—An improved manufacture of elastic stuffing for chairs, couches, and other articles requiring the same.
1528. Alexander White, Glasgow—Improvements in grinding or reducing grain and other substances.
1529. Ezra W. Burrows, Clerkenwell—Improvements in machinery adapted for increasing the efficiency of steam engine and other power.

Recorded July 9.

1530. Richard Roberts and George Coppock, Heaton Norris, Lancashire—Certain improvements in looms for weaving.
1531. Henry E. Flynn, Ranelagh, Dublin—Improvements in preventing fire from the overheating of hot-air flues.
1532. John Prophet, Broughty Ferry, Forfarshire—Improvements in the manufacture or production of confectionery.
1533. James Tetlow, Oldham—Certain improvements in machinery or apparatus for spinning cotton and other fibrous materials.
1534. Henry Crosley, of the Grove, Camberwell—Improvements in projectiles and the manufacture thereof for ordnance, cannon, rifles, muskets, and all descriptions of small arms, and also in the mode or modes of loading, using, and working the same.
1535. Alfred V. Newton, 66 Chancery-lane—Invention of a new manufacture of fire and burglar proof glass.—(Communication.)
1536. John and Anton B. Seithen, Regent's-square—Improvements in machinery for cutting and shaping cork.

Recorded July 10.

1538. George Riley, 12 Portland-place North, Clapham-road—An improvement in the construction of mills for grinding malt and other articles.
1539. James Palmer, Oldham—Improvements in machinery for carding cotton and other fibrous substances.
1540. Emile Kopp, Accrington, Lancashire—Improvements in mordants used in printing and dyeing.
1541. Richard A. Brooman, 166 Fleet-street—An improved means of securing wheels upon axles.—(Communication.)
1542. Henry E. Flynn, Retreat, Ranelagh, county of Dublin—Improvements in preventing the evil effects of the recoil of cannon.
1543. Charles J. C. Elkington, Hall-street, City-road—Improvements in depositing alloys of metals.

Recorded July 11.

1544. Henry Pratt, Worcester—Certain improvements in steam flour-mills, wind-mills, and water-mills, parts of which are also applicable for other useful purposes.—(Partly a communication from Edward Harrison, Connecticut, U.S.)
1545. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in apparatus or means for facilitating the performance of church and other music on organs, harmoniums, pianos, and other similar keyed musical instruments.—(Communication from François Guichené.)
1546. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the permanent way of railways, and in carriages to be used in connection therewith, or on common roads.—(Communication from Pierre J. B. Geoffrey, Dax, France.)
1547. James H. Nalder, Alvescott, Oxfordshire—Improvements in winnowing or dressing grain and seeds.
1548. Joseph Wilson, Manningham, near Bradford—Improvements in means or apparatus for the manufacture of rolling or piece boards, used in rolling or wrapping piece goods.
1549. Edmund Hart, Nottingham—Improvements in the manufacture of lace.
1550. John Coulson, Penzance—Improvements in apparatus for ventilating mines, which improvements are also applicable to other purposes where ventilation is required.
1551. Julius Jeffreys, Kingston-hill—Improvements in sun blinds or solar screens.
1552. Thomas W. G. Freeby, 1 Westbourne-terrace villa, Westbourne-terrace North, Paddington—Improvements in revolving fire-arm and cannon.
1553. Julius Jeffreys, Kingston-hill—Improvements in steam boilers.
1554. John Adams, Aldwincle, Northamptonshire—Improvements for indicating the time when persons commence and leave their work or calling.
1555. Charles F. Bielefeld, Wellington-street, Strand—Improvements in the manufacture of saddle-trees.
1556. William Williams, Bedford—Improvements in the manufacture of bricks, pipes, and tiles.

Recorded July 12.

1557. Benjamin Greening, Manchester—Improvements in machinery for washing and mangling, parts of which are applicable to churning.
1558. John Robinson and William Wedding, Manchester—Improvements in machinery for cutting paper, card-board, and other materials.
1559. John Bethell, 8 Parliament-street—Improvements in preserving meat, fish, fruits, and other eatables from decay, and for the purpose of their being used as provisions.
1560. Frederic H. Edwards, Newcastle-upon-Tyne—Improvements in obtaining motive power from fuel, air, and water.
1561. Edwin D. Chataway, Edinburgh—Improvements in buffing and coupling apparatus for railway carriages and rolling stock.
562. James Caldow and James B. A. M'Kinnel, Palmerstone Iron Works, Dumfries—Improvements in machinery or apparatus for cutting or reducing vegetable substances.
1563. Edward Simons, Birmingham—A new or improved instrument or apparatus to be used for condensing and absorbing the smoke and products of combustion arising from gas and other flames, and increasing the illuminating power of the said flames.
1564. John H. Weston, Cross-street, Newington Butts, Surrey, and John E. Lewis, Nicholas-street, New North-road, Middlesex—Improvements in the construction of moderator lamps.
1565. Romain D. Obissier, Rue St. François, Bordeaux—Improvements in obtaining motive power by hydraulic means.

Recorded July 13.

1566. Joseph H. Tuck, Pall-mall—Improvements in apparatus for condensing or exhausting atmospheric air or other elastic fluids.—(Communication.)
1568. Thomas Redmayne, Rotherham, Yorkshire—Improvements in stove grates.
1569. James Higgin, Manchester—Improvements in clearing and brightening dyed and printed fabrics.
1570. Samuel C. Lister, Bradford—Improvements in weaving looped or piled fabrics.
1571. George T. Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in the manufacture of boots and shoes.—(Communication.)
1572. Robert Cochran, Glasgow—An improvement in the preparation of clay for potters' use.
1573. Richard Hornsby, Spittlegate Iron Works, Grantham, Lincolnshire—Improvements in thrashing machines.
1574. Eugène Gillett, Bruxelles—Improvements in fixing artificial teeth.
1575. Major Lawton, Micklehurst, Cheshire, and Thomas Schofield, same place—Improvements in machinery or apparatus for preparing, spinning, winding, and doubling cotton or other fibrous substances.
1576. Richard A. Brooman, 166 Fleet-street—An improvement in pumps.—(Communication.)
1577. Robert Yeates, Trafalgar-place West, Hackney-road—Improvements applicable to the instruments termed "lock" knives and "lever" knives, part of said improvements being applicable also to such surgical and other instruments as may be connected to handles by moving joints.
1578. Louis Koch, New York—An improvement in machines for making pulp from wood and vegetable fibrous substances.
1579. Robert Burns, Liverpool—Improved teethed gear.
1580. Henry Grafton, Rolles-buildings, Fetter-lane—Improvements in the manufacture of fire-lighters, which are also applicable for other burning purposes.
1581. Pierre I. A. Gaudin, Skinner-street, Snowhill—Improvements in baths used for photographic purposes.
1582. Charles L. Neale, 1 Chapel-place, Cavendish-square—Invention of a new medicinal lotion, to be called 'The Crimean Neuralgic Specific.'
1583. Louis C. J. Poliesse, jun., and Charles A. J. Lengelée, Ham, France, and 32 Essex-street, Strand—Improvements in the manufacture of encaustic matters.

Recorded July 14.

1584. Joseph J. Derrieij, Paris—Improvements in machines for manufacturing lozenges, wafers, or pastiles of pasty materials.
1585. Francis Hamilton, Bolton-le-Moors, Lancashire—Improvements in adjusting the top cards or flats of certain carding engines.
1586. Thomas Sadlier, Mulla, Tullamore, King's County—An improvement in apparatus for heating liquids.
1587. Francis Burke, Woodlands, Montserrat, British West Indies, at present residing in London—Improvements in obtaining or preparing the fibres of the plaintain, banana, aloe, and other vegetables, for various manufacturing purposes.
1588. Edwin S. Atkinson, Knottingley, Yorkshire—Invention of an apparatus for condensing or absorbing muriatic acid gas from the furnaces or kilns used in the manufacture of sulphate of soda.
1589. John F. Kealy, Oxford-street—Improved machinery for the pulping of turnips and other vegetable substances.

Recorded July 16.

1590. William H. Tayler, 19 South-row, New-road, St. Pancras—Improvements in hermetically sealing preserve canisters and other vessels by means of a new arranged screw cap and fittings.—(Communication.)
1591. Antoine Regazzoli, Milan, Lombardy—Invention for impelling railway carriages up ascents.—(Communication.)
1592. Ludovico Gavioli, Modena, and 32 Essex-street, Strand—A new or improved musical instrument called clavi-accord.
1593. Jean B. Pascal, Lyons, France, and 32 Essex-street, Strand—Certain improvements in obtaining motive power.
1594. Joseph H. Tuck, Pall-mall—Improvements in blowing apparatus and other apparatus and engines, in which air and other elastic fluids are used.—(Communication.)
1595. James Newman, Birmingham, and William Whittle, Smethwick—Improvements in the manufacture of axles.
1596. Willam E. Newton, 66 Chancery-lane—Improvements in vices.—(Communication.)
1597. William E. Newton, 66 Chancery-lane—Improved mechanism for operating the shuttles of looms.—(Communication.)

Recorded July 17.

1598. Pierre Laroche, Saventhem, Belgium—Improvements in rotatory steam-engines.
1601. Scipion Salaville, Paris—An improved apparatus for airing and preserving grain, seeds, apples, potatoes, hops, and other similar articles in granaries, warehouses, and ships.
1602. William Jenner, Southwark—An improved beverage.
1603. Henry S. Boase, Claverhouse Bleachfield, Dundee—Improvements in the process of drying organic substances.
1604. Adam Burdess, 763 Old Station, Rugby—Improvements in the construction of oil feeders for lubricating machinery.
1605. Edwin Scragg, Albert Works, Buglawton, Congleton, Cheshire—Improvements in steam-engines.
1606. Henry Huthnance, Stratford—An improved method of effecting the combustion of coals as used in the production of heat.
1607. Edward Barry, Soho-square—An improvement in pianofortes, organs, seraphines, harmoniums, and other musical instruments played with a key-board similar to that of a pianoforte.

Recorded July 18.

1610. Felix Hoyos, Paris—Improvements in roasting spits.
1611. Thomas Almgill, Busby, near Glasgow—An improved mode of printing on calico and other fabrics and matters, and in machinery and apparatus to be employed therein.
1612. James Reilly, Dublin—Improvements in bending or shaping iron hoops for casks.
1613. Charles Toye, 42 Gloucester-street, Queen-square—Improvements in looms for weaving pile and terry fabrics.
1614. William Smith, Aston, near Birmingham—Improvements in the manufacture of steel wire for musical instruments, sewing needles, and other purposes.
1615. Thomas Trapp, Mile-end—An improvement in connecting and disconnecting screw propeller and other shafts.—(Communication.)
1616. John Ellis, Heckmondwicke, Yorkshire—Certain improvements in the process of manufacturing ammonia, charcoal, animal and vegetable naphtha.
1617. James Pollard, Woolwich-road, Bexley Heath, Kent—Improvements in the manufacture of gas.
1618. William Ball, Ilkeston, Derbyshire, and John Wilkins, Nottingham—Improvements in the manufacture of warp fabrics.
1619. James King and John Holdsworth, Moss Mill, Rochdale—Improvements in the manufacture of certain woven cotton fabrics.
1620. Auguste E. L. Bellford, 32 Essex-street, Strand—A new or improved method of condensing vapours and smoke.—(Communication from Frederic Kuhlmann, Lille, France.)
1621. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in the valves and passages for effecting the induction and eduction of steam in steam-engines.—(Communication.)
1622. Vincent Scully and Bennett J. Heywood, Dublin—Improvements in the construction of cocks and taps.
1623. Vincent Scully and Bennett J. Heywood, Dublin—Improvements in the construction of locks and latches, and in keys for same.

Recorded July 19.

1624. Robert Martin, Reading, Berkshire, and John C. Martin, 7 Pullens-row, Islington—An improvement in obtaining pulp from wood.
1625. John P. Clarke, Leicester—An improvement in the manufacture of metallic reels.
1626. Samuel B. Wright, Parkfield Stone, and Henry T. Green, Moreton, both in Staffordshire—Improvements in the manufacture of bricks and tiles.
1627. James G. Lawrie, Glasgow—Improvements in steam-engines.
1628. Piétro Bertinetti, Paris, and 4 South-street, Finsbury—Invention of a new safety projectile.
1629. David Fisken and Thomas R. H. Fisken, Stockton-on-Tees—Improvements in transmitting steam or other power for the tillage of land by ploughs and other implements, as well as for other purposes, and machinery for applying the power so transmitted.
1630. Edward A. Ferryman, Wadenhoe, near Oundle, Northamptonshire—An improved churn.
1631. James Thompson and James Mills, Manchester—Improvements in power-looms.
1632. John H. Woolbert, Brussels—Improvements in the preparation of extracts from madder, and in the application of the same directly to fabrics, in order to dye or colour them.—(Partly a communication.)
1633. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in transmitting motive power, principally applicable to horse-mills.—(Communication from Joseph Pinet, Abilly, France.)
1634. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in apparatus for actuating railway brakes.—(Communication from Charles Bricogne, Paris.)
1635. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture of reeds for weaving, and in the machinery or apparatus employed therein.—(Communication from Henry V. Wacrenier, Paris.)

1636. Thomas Broadbent, jun., Crawford-street—Improved apparatus for filtering liquids.
1637. Mathieu F. Isoard, Paris—Improvements in apparatus for generating steam, and for applying the same to motive power purposes.

Recorded July 20.

1640. Henry D. P. Cunningham, Gosport—Improvements in reefing sails.
1641. Archibald White, Great Misaenden, Buckinghamshire—Invention of swinging beds and covers, and tents to enable soldiers and others to sleep off the ground and dry, with or without an ordinary tent.
1642. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for obtaining motive power, applicable also to the raising, forcing, and exhausting air and other fluids, and partly to the kneading or working of dough or other pastes.—(Communication from André Koechlin, Napoléon Joseph Vicomte Duchatet, and Joseph Antoine Auguste de Perpigna.)
1643. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in axles for railways and other purposes.—(Communication from Edmond Roy, Villefranche, France.)
1644. George Conner, Liverpool—An improvement in the manufacture of brushes.
1646. Casimir Deschamps and Charles Vilcoq, Paris, and 32 Essex-street, Strand—Invention of a free diving-boat.
1647. Edmond F. Lefebvre, Orleans, and 32 Essex-street, Strand—Improvements in obtaining motive power.

Recorded July 21.

1649. Peter Armand le Comte de Fontaine Moreau, Paris, and 4 South-street, Finsbury—Certain improvements in the construction of voltaic batteries.—(Communication.)
1651. George H. Perry, Wolverhampton—An improvement or improvements in vessels or cases to be used for the preservation of articles of food.—(Communication.)
1652. Robert M'Laren, New Peckham, and Stephen W. Pugh, Peckham—Improvements in the manufacture of artificial fuel and fire-lighters, and in moulds to be employed therein.
1653. Edward Myers, Rotherham—Improvements in buffers and other springs for railway and other carriages.
1654. Charles Goodyear, 25 Avenue-road, St. John's Wood—Improvements in the surfaces used for printing.—(Partly a communication.)
1655. Samuel J. Pittar, 10 Lisle-street, Leicester-square—Improvements in the construction of bridges.—(Partly a communication.)
1656. Anthony Dugdale, Paris—An improvement in the construction of locomotive engines.
1657. John W. C. Wren, Tottenham-court-road—An improved construction of folding perambulator.
1659. George Hepplewhite, Grosvenor-street, Commercial-road East—Improvements in spare rudders for ships.
1660. William E. Kenworthy and Henry Greenwood, Leeds—Improvements in the construction of screw propellers.

Recorded July 23.

1661. Theophilus H. H. Kelk, Osgathorpe, near Loughborough, Lancashire—Invention for rendering certain vegetable substances useful for the manufacture of paper, and the formation of textile fabrics, and cordage or ropes.
1662. Henry W. Ripley, Bradford—Improvements in dressing and finishing woven fabrics composed wholly or partly of wool.—(Partly a communication.)
1664. Charles Goodyear, 25 Avenue-road, St. John's Wood—An improvement in manufacturing moulded articles made of compounds of india-rubber.—(Communication.)
1666. Charles Goodyear, 25 Avenue-road, St. John's Wood—Improvements in the manufacture of combs.
1667. Charles Goodyear, 25 Avenue-road, St. John's-wood—Improvements in the manufacture of boats and other vessels.
1668. Auguste Achard, Chatte, near St. Marcellin (Isère), France, and Paris—Improvements in the application of electricity as a transmitting agent of motive power.
1669. George H. Rollett, Liverpool—Improvements in projectiles for fire-arms.

Recorded July 24.

1670. William G. Craig, Gorton, near Manchester—Improvements in the mode or method of consuming smoke, and in the machinery or apparatus employed therein.
1671. Louis A. Ritterhandt, Warwick-street, Regent-street, and Joseph Bower, Hunslet, near Leeds—An improvement in the manufacture of manure.
1672. Lonsdale Bradley, Richmond, Yorkshire—Improvements in reaping machines.
1673. Joseph Westwood and Robert Baillie, Poplar—Improvements in preserving timber-built ships, also timber or wood and wrought-iron used in situations exposed to the action of water or of weather.
1674. Henry Stent, Birmingham—Improvements in the construction of apparatus for measuring gas and other fluids.
1675. Samuel Twist, Birmingham—An improvement or improvements in producing ornamental inscriptions and devices on glass.
1676. Benjamin Wood, Caledonian-road—An improved preparation of colouring matter for the manufacture of ink, artists' colours, and for other purposes for which such colouring matter may be applicable.
1677. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in breech-loading and self-capping fire-arms, and in percussion caps or primers, and in the mode of applying such percussion caps or primers to fire-arms.—(Communication from William Pratt, Baltimore, U.S.)
1678. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in breech-loading ordnance and fire-arms, and in their projectiles.—(Communication from William Pratt, Baltimore, U.S.)
1679. Samuel E. Steane, Oxford—Invention for the application of perfumery to articles of domestic use, such as candles, starch, washing-blue, lamp-oil, and such like articles.
1680. Richard A. Brooman, 166 Fleet-street—An improvement in machinery for making pipes and tubes.—(Communication.)
1681. Tony Petitjean, Tottenham-court-road—Improvements in silvering, gilding, and platinizing glass.
1682. Thomas Hewitt, Morley-park Works, near Belper, Derbyshire—Improvements in pumps.
1683. Richard P. Huthnance, Chipping Norton, Oxfordshire—Improvements in drying, and in apparatus to be used therein.
1684. Benjamin Bailey, Leicester—Improvements in manufacturing knitted fabrics.
1685. George T. Bousfield, 8 Sussex-place, Loughborough-road, Brixton—Improvements in cutting wood.—(Communication.)
1686. Charles Goodyear, 25 Avenue-road, St. John's-wood—Improvements in the manufacture of carriages and other vehicles.
1687. Jean B. M. Potin and Antoine G. N. Lingée, Paris—An improved composition applicable to the coating of iron, wood, stone, metals, and other substances.

Recorded July 25.

1688. Edward S. Tucker, Kentish-town, Middlesex—An improved busk and hook for stays.
1689. Jacques Girard, 5 Rue Notre Dames de Grâce, Paris, and 77 Chancery-lane—Improvements in generating and applying steam to rotary engines of an improved construction.
1690. Vincent Scully and Bennett J. Heywood, Dublin—Improvements in vessels for containing and preserving fluids.
1691. William Weallens, 12 Elswick Villas, and George A. Crow, Forth-street, Newcastle-on-Tyne—Improvements in steam-engines.

Recorded July 26.

1692. David Davies, Heaton-lane, Stockport—Invention of a self-evident economic boiler for heating with hot water buildings of every description.
1694. Thomas M. Hall, Preston—Improvements in the construction of chimneys, more particularly applicable to the chimneys and funnels of locomotive and marine engines.
1696. John Gedge, 4 Wellington-street South, Strand—Improvements in pumps.—(Communication.)
1698. Thérése A. Poncelin, Paris, and 32 Essex-street, Strand—Improvements in treating or preparing coffee.
1700. Robert H. Hancock, 18 West-street, Smithfield—Improvements in the means of stopping carriages or trains to prevent railway accidents.
1702. Thomas Dawson, King's Arms-yard—Improvements in bedsteads, couches, and other like articles of furniture, whereby parts thereof can be made to form a fire-escape when required.
1704. Charles Goodyear, Avenue-road, St. John's-wood—Improvements in carpet and other bags.—(Partly a communication.)

Recorded July 27.

1706. William Allen, of the Athenæum Club, Pall-mall—Invention of a new vehicle for the transport of camp baggage.
1708. John A. Benfield, Rotherhithe, Surrey—Improvements in propelling vessels.
1710. William Bridgewater, Cheltenham—Certain improvements in the manufacture of roofing and other tiles.
1712. John Whitehead, jun., Elton, near Bury, and Robert K. Whitehead, same place—Improvements in the manufacture and finishing of textile fabrics.
1714. George Woods, 60 and 61 Crown-street, Finsbury-square—Improvements in pack saddles.

Recorded July 28.

1716. Henry R. Abraham, 11 Howard-street, Strand—Invention of a carriage on two wheels for passenger traffic, and general conveyance of a number of persons or invalid or wounded persons, to be called a rotalta.
1718. François G. H. Levavasseur and Auguste J. Levavasseur, Paris—Improvements in oil lamps, and an improved chimney for oil lamps.
1720. Robert Wilson, Glasgow—Improvements in folding and preparing or pressing woven fabrics and other materials.
1722. James Kerr, Bedford-terrace, Trinity-square, Southwark—Improvements in revolver fire-arms.
1724. Thomas B. Daft, Isle of Man—Improvements in inkstands.

Recorded July 30.

1726. James Peacock and Henry H. Barry, Bedford-street, Strand—Improvements in instruments for making copies of writings simultaneously with the originals.
1728. Charles Piper, Cambridge—Improvement of gun-stocks of every description used both for sporting and military purposes.
1730. William Truran, Marazion, Cornwall—Improvements in smelting, and in apparatus to be used therein.
1732. John Hanson, Doagh, Belfast—Improvements in machinery or apparatus for digging potatoes.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

DESIGNS FOR ARTICLES OF UTILITY.

Registered from July 9th to August 23d.

July 9th,	3734	Abbott & Forest, Blackburn,—"Steam valve."
16th,	3735	J. W. and T. Allen, Strand,—"Folding bedstead."
—	3736	F. W. Ralph, Throgmorton-street,—"Envelope paper."
17th,	3737	A. H. Jones, Helmet-row,—"Pocket detector."
24th,	3738	W. N. Nicholson, Newark,—"Washing machine."
—	3739	T. Green, Leeds,—"Mowing machine."
27th,	3740	J. S. C. Hill & C. Coe, Manchester,—"Camp cloak."
Aug. 4th,	3741	J. Shaw, Brighton,—"Soap-cutting machine."
8th,	3742	G. R. & J. Bengough, Tichborne-street,—"Portmanteau."
11th,	3743	Littlehales & Green, Birmingham,—"Tray edges."
13th,	3744	E. Israel, Milk-street,—"Reel."
14th,	3745	C. F. Dennet & G. Pays, Notting-hill,—"Percussion cap and cartouche pouch."
16th,	3746	S. B. Woolf, Old Bond-street,—"Trousers alliance."
23d,	3747	E. Israel, Milk-street,—"Reel."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered.

June 29th,	675	J. Moon, Malton,—"Bath."
July 2d,	676	Carrett, Marshall, & Co., Leeds,—"Engine and boiler."
4th,	677	G. B. Davis, Halifax,—"Vest."
7th,	678	P. Gordon, Goodman's-fields,—"Reckoner."
11th,	679	G. J. Calvert, York,—"Cooking apparatus."
12th,	680	D. S. Brown, Old Kent-road,—"Aerial machine."
18th,	681	J. Moon & G. Andrews, Malton,—"Oat bruiser."
21st,	682	W. Ryan, Dublin,—"Hoop-bending machine."
27th,	683	S. Bullock, Battersea,—"Siphon tap."
28th,	684	D. Wheatley, Barnsbury,—"Albert boot."
30th,	685	J. Hunt, New Kent-road,—"Bill head."
Aug. 10th,	686	Capt. Chiosso, Oxford-street,—"Polymachinon."
11th,	687	F. Wicksteed, Upper St. Martin's-lane,—"Carriage-spring brace."

TO READERS AND CORRESPONDENTS.

Received.—"On the Uses and Application of Cavalry in War," by N. L. Beamish, Lieut.-Colonel.—"The Iron Manufacture of Great Britain," by W. Turner, C.E.

MARINE COMPASS
WITH ADJUSTABLE CORRECTIVE MAGNETS.

A. SMALL, GLASGOW.

Fig. 1.

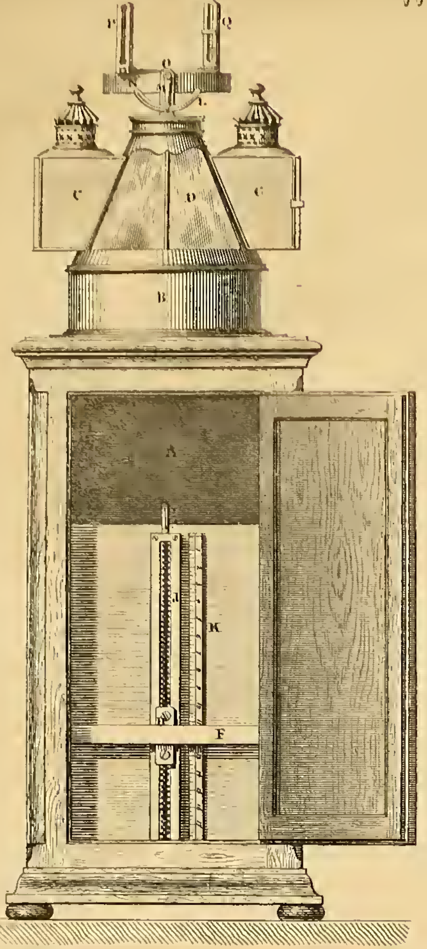


Fig. 3.

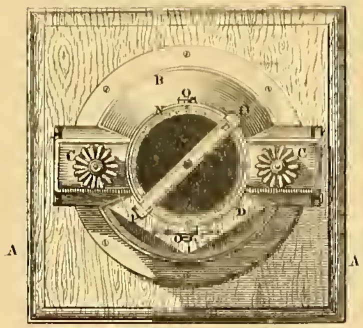


Fig. 4.

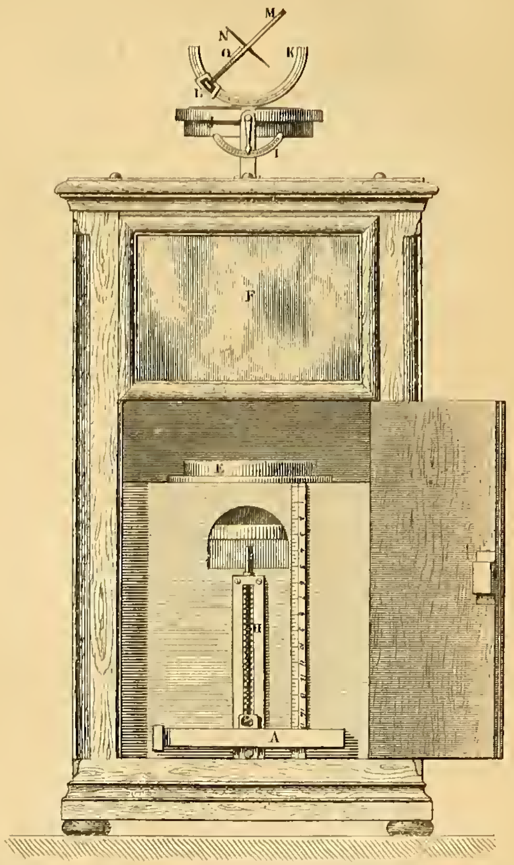
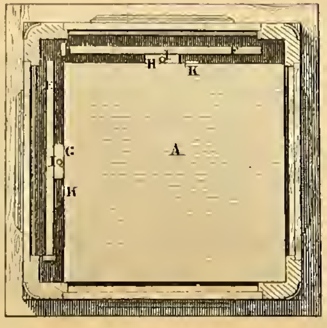


Fig. 2.



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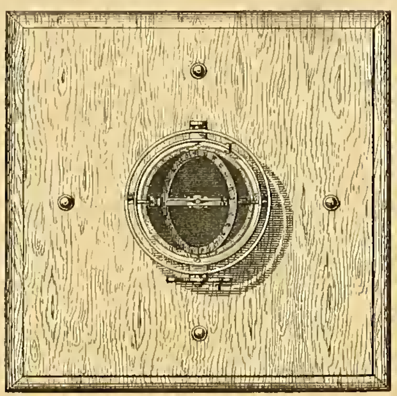
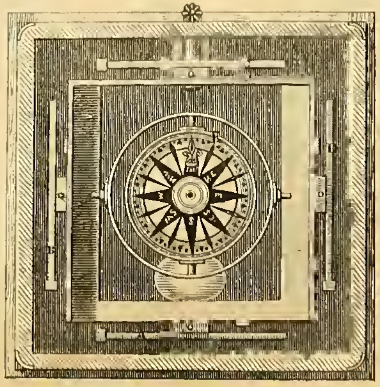


Fig. 6.



SCALE

INDIA RUBBER SPRINGS,

W. C. FULLER PATENTEE.

2, BUCKLERSBURY, CHEAPSIDE, LONDON.

Fig. 1.

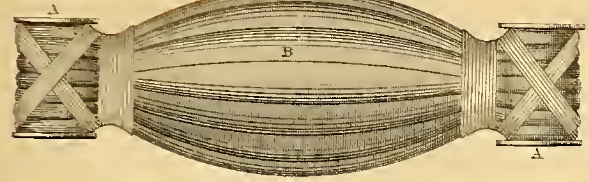


Fig. 2.

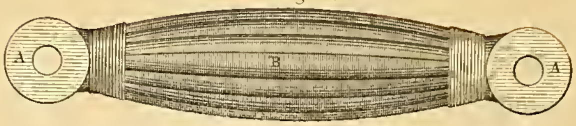


Fig. 3.

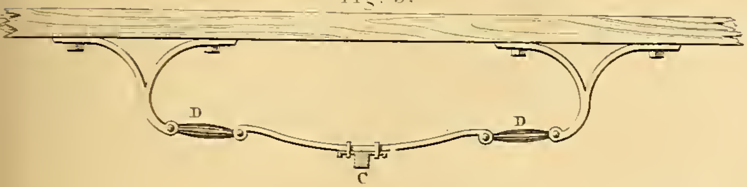


Fig. 4.

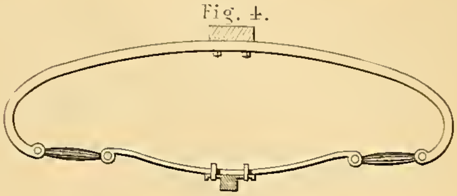


Fig. 5.

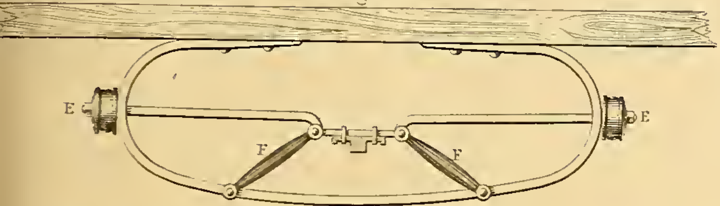
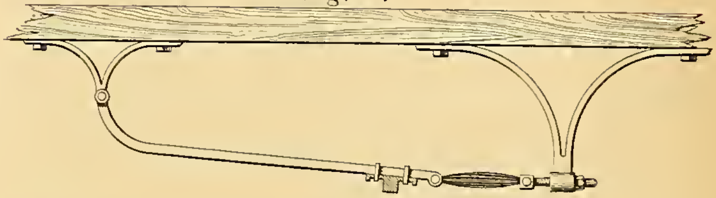


Fig. 6.



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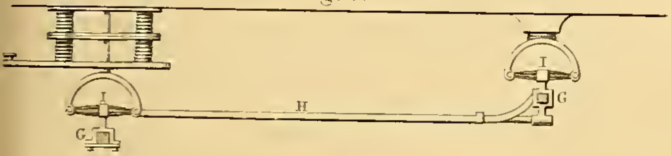


Fig. 10.

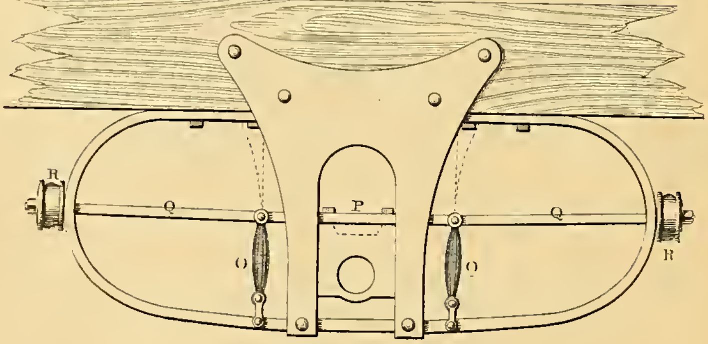


Fig. 8.

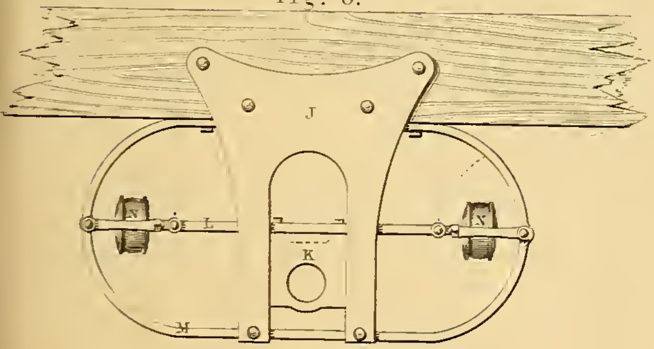


Fig. 11.

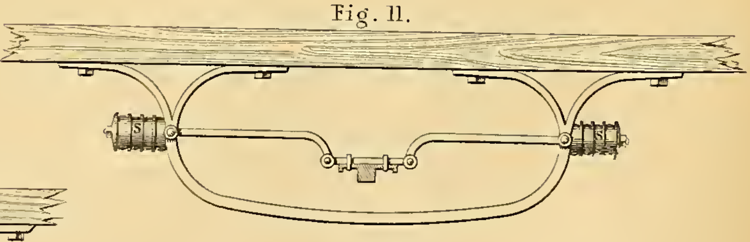


Fig. 12.

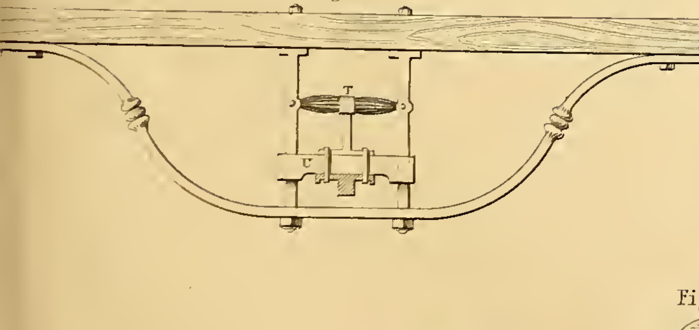


Fig. 13.

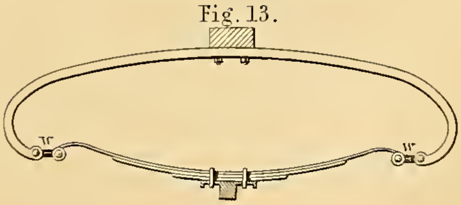


Fig. 16.

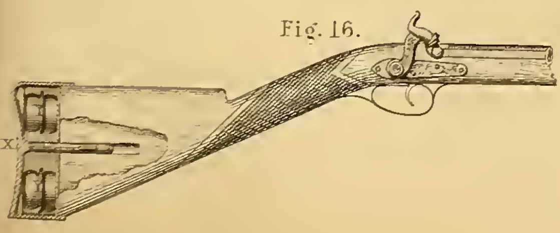


Fig. 14.

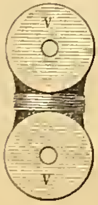


Fig. 15.

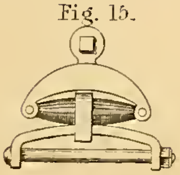
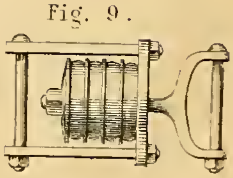


Fig. 9.



THE GREAT EXHIBITION AT PARIS, 1855.

(FROM OUR OWN CORRESPONDENT.)

II.

In one respect the Paris Exhibition is very inferior to our own in 1851. The insufficiency of the exhibition space first contemplated by the French commissioners has led to a degree of confusion and inconvenience in the general arrangement of the exhibited objects, which must forcibly strike those who remember the excellent classification adopted at Hyde Park. This defect is most severely felt by those desirous of studying any particular branch of industry. They find themselves bewildered by the scattered disposition of the materials, the examination of which is needed to complete the lesson they are trying to learn; and after the subject of their study appears to be exhausted, they are sure, however careful they may have been in their search, to come unexpectedly upon new materials demanding a continuation of their investigations. The impression of a great design wonderfully elaborated in all its details, so strikingly presented in Hyde Park, is entirely wanting in the Champs Elysées, and an idea of general inferiority will, in consequence, probably be suggested to the superficial observer in the latter place. A closer examination, however, of the mass of objects there collected will demonstrate their superiority over the like things shown in 1851. Every branch of industry marks some strides of progress—one country being more prominent in one branch, and another country in another branch, whilst all show a general advance. In the French department, whilst the machinery exhibited does not quite come up to the British standard of excellence, it nevertheless shows an immense improvement, and is remarkable for its extent and variety, showing how rapidly our neighbours are treading on our heels; and that whilst they gladly copy from us what they think good, they can still invent and perfect new forms and contrivances for themselves. Whilst the advance in machinery forms the most striking feature of the French display, the great national industrial establishments fully indicate that they have not been at a stand-still.

In the English department of the Exhibition there is not as extensive a display of machinery as might have been expected. What is shown is excellent, but there are no striking novelties. In everything to which ornament is applicable a great improvement has been effected since 1851, as may be particularly noticed in reference to furniture, pottery, ornamental textile fabrics, and also metal work. Whilst, however, more attention has been given to ornamentation, none the less has been bestowed on the soundness and excellency of the workmanship. Our colonies, however, show as large an advance as the mother country, if not a larger one. Canada and Australia, indeed, so strongly demonstrate their advancing industries, and enlarged productive resources, that England herself has not better grounds than they afford for self-congratulation. From the specially useful and plain character of British industrial products she cannot of herself make so resplendent a display as France; and the collections exhibited by her colonies, and particularly that of the East India Company, are of the greater value, as, to some extent, making up this difference. England, however, can well afford to set her useful manufactures against the more ornamental French productions—the fruits of untrammelled private enterprise against the costly triumphs of Sèvres and Gobelins, and the wealth of self-governed colonies against the most brilliant results of centralization. With regard to the British collection, it is also noticeable that the exhibitors for the most part send mere samples of what they are in the habit of producing in the regular course of trade; whilst France and the other Continental countries have used extra exertion to produce special objects for "the show." Thus, in machinery, the Continental exhibitors have expended an immense deal of minute finishing and hard labour on parts which, in the English examples, are not touched after casting, or after leaving the machine tools. In the department of the Zollverein there are obvious indications that the lessons afforded by the Exhibition of 1851 have been well studied. Krupp, whose display of cast-steel at Hyde Park was so much admired, here shows proofs of a very considerable advance. Austria stands forward in the production of woollen cloths of superior quality, and of extraordinary cheapness. The United States make the poorest show when it is considered what they might do. They evidently deem it out of the way to cross the Atlantic for the purpose of exhibiting their supposed "go-ahead" tendencies, probably under the impression that no practical or commercial advantage would be gained thereby.

We brought our last month's notice of this Exhibition to a pause under the impression that we had traversed the entire floor of the main building; we find, however, that to complete this portion of our labours, we have yet to notice the contents of the spaces appropriated to Austria and the States of the Zollverein in the south-western portion of the building under the galleries.

In the Austrian department, we first observe, towards the back, a large collection of woollen goods, comprehending some ordinary cloths of peculiarly brilliant colours; also, some finer kinds, the latter from Brünn. Near this is a great variety of articles from Vienna, such as buttons, toys, musical instruments of the accordion class, meerschaum smoking pipes most elaborately carved, beautifully ornamented fireproof safes by F. Wertheim; also, some excellent tools by the same producer, and a few inferior photographs by Sacchi and Dr. Lorent.

In the Prussian department, the first noticeable collection is a very complete and excellent series of cloths, chiefly from Aix-la-Chapelle. Near this space is some tinware, which is not worth exhibiting even on the score of cheapness, being dear at any price. Some cast-iron goods here are also poor. These consist of bronzes, fountains, and stoves, the last having thrown away upon them much elaborate and minute ornament, wholly wanting in merit as to design. There is also a small collection of tools, cutlery, and needles, all of inferior order, and a zinc trophy from Silesia. Proceeding onwards, we find ourselves amongst Berlin metal ware, both useful and ornamental, and notice particularly a beautiful book back in oxydised silver; also, a small figure of the Amazon in silver, partly gilt, and a neat candlestick of frosted and burnished silver. Friedburg of Berlin has some beautiful jewellery, and articles in gold and silver, in a kind of court towards the centre of the palace, at this part where is also a collection of articles in amber. Here are also some beautiful specimens of painting upon metal, the chief object of this kind being a four-leaved screen, with female figures representing the seasons—most beautifully executed. In the Prussian space there merely remain to notice a collection of arms, another of fine bronze table ornaments, some safes from Magdebourg and Berlin, an assortment of leaden toys, and a splendid oval table in polished Silesian marble.

Baden, on whose territory we next enter, has stalls exhibiting her various textile manufactures, amongst which are cotton velvets, shawls, and prints, very much resembling Manchester productions. Here are some samples of excellent wire cloth for paper machines, and a collection of clocks from the Black Forest.

Luxembourg and the other minor states exhibit very little worthy of notice. There are a richly ornamented bronze cabinet; a collection of pencils and crayons from Faber of Bavaria, who is said to supply almost the whole Continent with these articles, besides exporting to this country; lithographic stones of large size, exhibited by Schwartz; ornaments in glass from Würtemberg, Bavaria, and Munich, those from the latter place comprehending a pretty column, with flutings in blue, red, and white-opaque glass resembling wax; and some handsome glass vases with Egyptian devices gilt upon them. These last-mentioned objects are ranged along the side of the western entrance, the end of our travels below stairs.

On ascending to the galleries, we make an agreeable change from darkness to light. Six double stone staircases, of large size and massive construction, are placed in the portions of the building which project outside the rectangular outline, being arranged so as not to take away from, or break up, the internal space. The galleries are bounded towards the centre of the building by iron pillars and frames, which support the central semi-cylindrical portion of the roof, and a clear passage is formed completely round the galleries through these pillars and frames, which, being tastefully ornamented with white curtains and chandeliers, present very pretty avenue-like vistas. Whilst mentioning the chandeliers, we may remark that the great quantity spread over the Exhibition, for the most part indicate a falling off from elegance and simplicity of design. The makers seem to vie with each other in a lavish prodigality of ornament, and the prevailing desire seems to be to produce the appearance of unsymmetrical masses of broken glass.

On the landing place of the staircase in the north-western corner of the building, is exhibited Foucault's mechanism for ocularly demonstrating the earth's rotation. An electro-magnetic apparatus fitted up below the table over which the pendulum travels back and forward, keeps up the motion by imparting a fresh impulse at each vibration—a contrivance which, we fear, will be apt to make the ignorant and incredulous fancy that the apparent rotation is also caused by the apparatus below the table. A demonstration of this kind should be free from anything that may leave the slightest doubt in the mind of the observer. We shall commence our tour of the galleries from this, the north-western corner, and shall proceed along the northern side, which is all occupied by France, with the exception of some small spaces towards the centre at the two ends. Switzerland occupies the first of these spaces, and makes a splendid show of laces and embroidered muslins, the designs of which last are generally rich and graceful, whilst one or two are curious, such as an embroidered landscape, in which the trees are made to accommodate their outlines to the profile of the Emperor. This space also contains some beautiful silks and prints from Zurich; some pretty Helvetian straw lace; a collection of Swiss drawing instruments, watchmakers' tools, and watches, and some interesting samples of Swiss wood-carving. Spain and Portugal occupy the next small spaces, and the collections of both are extremely meagre. Spain exhibits a few good Barcelona silks, a pretty silver or silver-plated chandelier, and some exceedingly good lithographic illustrations of Don Quixote. In the Portuguese space there is nothing worthy of notice. In the French space the Paris jewellers and goldsmiths line with their well-filled cases the side of the avenue overlooking the nave, whilst at the back is the splendid exhibition of Lyons silks. In the last is an interesting and complete collection, illustrating the silk manufacturing processes from the worm, or rather from the mulberry leaf, to the many-hued web fit for an empress' wear. Near the centre of this, the northern gallery, are the retiring rooms of the Empress, magnificently furnished in the style of Louis XIV. We did not obtain a sight of the interior, however, as it involved a great loss of time from the constant stream of people, at the tail of which the curious observer must abide in patience his turn of admittance. Passing onwards, we notice an extensive collection of Parisian artificial flowers, containing some astonishingly close imitations of nature; some very beautiful French laces, comprehending a toilette of Alençon point purchased by the Empress; an extensive collection of French printed cottons, Mulhouse and Rouen chiefly supporting the high character which these productions possess; and a large and varied assortment of Parisian millinery, comprehending all that can charm the eye of a Parisian belle. At the end of the French space is a splendid large mirror from Montluçon. Towards the centre, at this end of the gallery, are two small spaces occupied by Sardinia and the Roman States. The former has a varied collection; but it is much smaller than might have been expected. It contains, amongst other things, some good furniture, with wood Mosaic ornamentation; some beautiful velvets and laces; and a collection of splendid meerschaum pipes, one of which, richly jewelled, is turned by clockwork to display its beauties. The most remarkable objects in the Roman space are some fine Mosaics, principally in the form of table tops, and an extraordinary drawing of a human head, made up of hundreds of human figures piled together in every conceivable fantastic position.

The short gallery across the eastern end of the palace is divided into a number of small spaces, occupied respectively by Tuscany, Greece, Tunis, Turkey, Egypt, China, and Persia. In the Turkish space are some interesting photographs from Bucharest. Strangely placed in the midst of the Chinese and Persian collections, is a handsome trophy from Sunderland, containing a series of models of ships and life-boats, placed in glass cylinders, and one or two models of anchors.

We now arrive at the south-eastern corner staircase, at which point commences the English gallery space. The vestibule, or landing place of the staircase, is occupied by a very interesting collection from Australia, the most valuable portion of which consists of two cases of gold nuggets, containing one piece 350 ounces in weight, and two very pretty figures, in pure Australian gold, of diggers with their various implements, priced at £120 each. The collection, however, is not confined to gold nuggets. There are cabinets made of various Australian woods; specimens of wheat and flour and of wools, and minerals of various kinds. There are also a few articles made of Australian iron, which, though of but rude workmanship, are enough to show that this important manufacture has been commenced in the colony. The eastern end of the British gallery space is occupied by the East Indian collection, which is much more complete than that exhibited by us in Hyde Park. The objects are arranged in stalls very appropriately decorated by Mr. Wyatt. There is not in the whole exhibition another collection richer or more curious, or one that more completely represents the industrial pursuits of the people from whose country it is derived. Besides curiosities of various kinds, the European may here see rich and delicate fabrics, ornamented by designs the gorgeousness and elegance of which have not yet been equalled by the highest efforts of art in his quarter of the globe. The poor Hindoo artist, who seems long ago to have attained the highest point, is still our master in artistic design. Leaving the Indian space, we enter amongst the richly loaded cases of the London gold and silver smiths and jewellers. We cannot spare space to detail the magnificent racing and presentation pieces—some in frosted silver of purest white—the diamond garter ornaments and other splendid pieces of jewellery, and the various articles made of beautiful pure Australian gold. We must, however, observe that these things surpass everything else of the kind in the Exhibition, in artistic design, as well as in mechanical execution. Towards the back, at this part, are cases of boots and shoes and small brushes; the waterproof fabrics of various manufacturers, amongst whom Edmiston exhibits a large air cushion in the shape of a life boat. Along the wall, in large stalls or bays, are ranged printers' and publishers' collections, where the well-known London firms appear to especial advantage. De-la-Rue's envelope-folding machine, of Hyde Park notoriety, is there. Baxter exhibits his pretty oil-colour prints. Waterlow & Son have a fine assortment of stationary, and Day & Son some beautiful lithographs. The London and Glasgow Art Unions show their engravings, and the English photographers their beautiful sun pictures. Of photographs, the English collection is the best in the Exhibition; but the French do not put forth their full strength there. The Paris Photographic Society have a private exhibition at their rooms in the Rue Druot, which is much superior to anything we have seen elsewhere. The wall-side range of collections is terminated by one sent by the Government School of Design, the subjects for the most part being interesting only as showing the rapid progress of the pupils, and by the maps and plans of the ordnance survey of Scotland. In the centre of the gallery space, the collections are chiefly noticeable for their miscellaneous nature. Mechi is here in his original character of dressing-case and papier maché ware seller, and Leuchars, close by, shares the public admiration for these kinds of things. Their display is not what it might be, as any one will say who has been in metropolitan, or even provincial shops devoted to this business. Hereabouts are some good English carpets; but the carpets are everywhere in the Exhibition, and any one desiring to study this particular branch of manufacture, will need great store of patience to make out from the confusion such important points as he is in search of. In fact, the carpets are made to serve the purposes of the Exhibition commissioners and decorators, as well as those of the exhibitors. In a place like the Exhibition, large masses of material, rich in colour, like carpets, are extremely useful in dividing off spaces, filling up blanks, and covering bare walls. Thus the splendid French carpets of Braquênie and of Requillart & Co. are to be found on the walls of some of the staircases utilizing spaces otherwise not easily covered to advantage.

Passing westwards from Mechi's cases, we notice a long series of English silks, containing some exceedingly good examples both of texture and colour. There are also some fine samples of Paisley shawls, of Nottingham laces, and a few of beautiful embroidered work; some pretty coloured wax figures, and some cases of gloves, hosiery, and such like. The English gallery space is terminated by a court containing philosophical instruments, geometric models, electro-telegraphic apparatus, specimens of Newall's submarine cable, watches and chronometers, model of the Earl of Rosse's telescope, and a set of Wyld's globes, one of which —we omitted to mention—forms the picturesque crest of Roger's naval trophy down stairs.

A space here originally designed for the United Stated appears not to have been occupied by them, and is taken up by some French pianos and organs, amongst which last is one remarkable for the amount of expression, approaching that of the human voice, of which it is capable. The quality of its tone, however, did not please our ears. We are now at the centre of the south gallery, at the front of which, facing the nave, is a large clock by Collins of Paris, which regulates two others at the two ends of the building by electric means every two seconds. At the back, in the vestibule of the southern central staircase, is a large and curious clock from St. Loup, which indicates the time, and also shows the state of the tide at several different places. The seasons, days of the week, and other chronal matters, are indicated by means of puppets and devices of various kinds.

Pursuing our westward route along the gallery, we scarcely pause to notice the names of the insignificant collections from Mexico, the Argentine Confederation, and Guatemala, which would be more appropriately situated in a museum of curiosities than in the Palace of Industry. We are sure such places as these, and as Brazil, for example, which is nowhere in the Exhibition, could have sent most valuable and instructive collections of raw products, and even of some of the ruder manufactures. We would suggest to the managers of future exhibitions, in this part of the globe, to send special agents to these out-of-the-way corners to encourage and persuade the natives to make an appearance, and prove themselves worthy of a place in the world of industry.

The Belgian gallery space into which we next enter, reminds us, from the nature of its contents, of the down-stairs spaces of other countries; for we find some heavy marble chimney-pieces, amongst which is a very richly sculptured white one. There are also specimens of pottery, china, and glass, the last of a plain description, and chiefly noticeable for its cheapness. There are several pianos and organs, the latter small; and on the walls are some fine Brussels carpets, whilst towards the western end of the space is a collection of cotton fabrics, which, though small, is exceedingly good, and does great credit to the Belgian manufacturers.

Austria has hereabout as much gallery space as Belgium, the most striking collection contained in it being one of splendid silks from Vienna. There are also some fine shawls, laces, ribbons, damasks, and embroidered work, an extremely rich table cover being amongst the last.

In the Prussian and general Zollverein space, which comes next, is a large collection of excellent specimens of printing, including letterpress, plate, and colour printing. There are a few very good photographic portraits, and one specimen which is perhaps not surpassed in the Exhibition. It is a portrait of eight chess players—continental celebrities, we presume—and it must have been taken instantaneously, so varied, easy, and natural are the positions and expressions of the party. The colour of this and the other Prussian photographs is very pure and beautiful. This portion of the Prussian space is not without its show of textile fabrics, amongst which we notice diapers, damasks, and other linen goods; woollens, velvets, fringes, Saxony damasks and laces. Berlin wools and patterns for them are, of course, here in abundance, and of the best quality, and there are also some oil-cloth table covers.

The small German States occupy the remaining portion of the southern gallery, and here there is very little that is striking. Perhaps we may mention some neat jewellery, and some amber ornaments from Hesse; brushes, telescopes, inferior photographic portraits, and paintings on porcelain from Bavaria.

Turning along the west end transverse gallery, we enter the small Danish compartment, containing an assortment of various fabrics, some silver work, furniture, and musical instruments. Here is the Danish type-composing and distributing machine, by Sorensers, considered to be the best in the Exhibition, and said to be employed upon a Copenhagen newspaper.

Adjoining the Danish court is that of Sweden, the most interesting object in which is Scheutz' calculating machine. A descriptive notice of this ingenious machine was given in this journal in June last. As some little difficulty appears to be experienced in comprehending the principle upon which this calculating machine acts, we may here give an explanatory illustration of its working, referring to our former notice of the mechanical details. Supposing it is desired to work out the cubes of the numbers 1, 2, 3, 4, &c.—as simple a case as can perhaps be taken—let us set down a few of these cubes, thus:—

1 8 27 64 125
7 19 37 61
12 18 24
6 6

In the second row, and below the spaces of the terms above, place the differences between those terms. In the third and fourth rows similarly place the differences between the terms of the second and third rows respectively. We find that the terms of the fourth row are all sixes (and this will be the case however many terms we set down in the first row). From this we derive a rule for obtaining the cubes by the repeated addition of the constant number 6. In working out this simple calculation in the machine, four horizontal rows of wheels will be called into play, the top row representing the products. At starting, the second row will be set to indicate 1, and the fourth, 6, whilst the first and third rows will show zeros, as at A.

0	1	1	8	8	27	27	64
1	1	7	7	19	19	37	37
0	6	6	12	12	18	18	24
6	6	6	6	6	6	6	6
A	B	C	D	E	F	G	H

At the first movement of the machine, the amounts indicated by the second and fourth rows are added respectively to the first and third, as at B, the top one indicating the cube of 1. At the next movement, the number indicated by the third row is added to the one immediately above, as at C. It requires two movements, however, to complete a stroke or calculation of the machine, as every number indicated must be added to that above it, the alternate ones being operated upon at each movement. Thus, at the next movement, the second and fourth numbers are added to the first and third, as at D, making the top figure 8—the cube of 2. Two more movements produce the alterations shown at E and F, the latter showing the cube of 3, and the changes G and H show the cube of 4. Proceeding in this way, each couple of movements produces the cube of a number differing from the last by one. All regular series can be calculated in this manner, as can all tables the terms of which, when treated as above, show a constant difference after a less or greater number of operations.

In the Swedish space is a porphyry table sent by the king of Sweden to the Empress Eugenie. There are also a few models of vessels, bridges, and other engineering works, and some philosophical instruments and apparatus; two good-sized cases of textile fabrics, a collection of the well-known Swedish gloves, and some fine furs. In the Norwegian space adjoining, are some curious native costumes and furniture. The Dutch space, which comes next, terminates our tour of the galleries. It contains some curious furniture, a few specimens of woollen manufactures and carpets, some models of galeots, which tub-like build of vessel these Hollanders persist in retaining, and some models of bridges and canal works.

Leaving the main building by the southern doorway, we proceed towards the long Annexe, taking the Panorama building in our way. This latter erection consists of a central circular divan, encompassed by an outer circular gallery, with which it communicates at four several points, both spaces being entirely devoted to French productions. Taking an eastern direction from the north entrance round the outer circle of the panorama, we first enter an extensive and magnificent collection of musical instruments—pianos, harmoniums, and harps occupying the floor space, and violins and wind instruments being disposed along the outer wall space. At the end of this musical instrument space is a large organ by Ducroque, close to which is a trophy of iron castings of various kinds—chiefly figures imitating bronze and plaster of Paris. This collection is exhibited by J. J. Ducel, and contains some very excellent work. Aloft, beautiful paper hangings adorn the outer walls, and carpets line the inner partition. The lower part of this partition is divided into bays or stalls, the first of which contain furniture, some of it ingeniously convertible in appearance from bed-room to sitting-room furniture. Further on, these stalls are occupied by ironmongers, tool venders, and by collections of spindles and other details used in the textile manufactures. Extensive ranges of cutlery cases occupy the body space, where are also the displays of ironmongers, lamp-makers, tinsmiths, locksmiths, braziers, and coppersmiths, extending to the outer walls. Passing on, we next notice the splendid collections of the Parisian gunsmiths. Into this department even, the desire for excessive ornamentation has found its way; and the beautiful fowling-pieces of Gouvain, Perrin, Glaudin, and Devisme, are as remarkable for excellence as works of art, as they are as weapons of destruction.

Having made half the circuit of the building, we pass the staircase leading to the long Annexe, and first enter a kind of outer court, in which is a beautiful display of designs, chiefly of an ornamental character, and intended for textile fabrics. Here are also some magnificent photographs of bouquets of flowers, executed by Braun of Mulhouse, to serve as studies for designs. These photographs are of a very large size, and are excellent both in execution and in the artistic grouping of the flowers. This half of the outer circle is almost entirely filled with furniture. There is a beautiful imitation ebony and gilt bed and wardrobe by Méchin; some richly and artistically ornamented cast-iron bed-frames by Dupont; portable folding metallic beds by Leonard; and elegant bed-room furniture by Descartes. Near the last are some cottage spinning wheels, of an improved construction, by Gautier, making the old form look quite clumsy in comparison; some beautifully carved wood chimney-piece ornaments by Thiebalt; and a large pulpit-piece, designed by the Abbé Choyer, curious rather than artistic or elegant. Here, as at other parts of this outer circle, the higher portions of the walls are decorated by paper hangings and carpets, the former being chiefly of the landscape or panoramic class. Passing amongst some billiard tables and a large quantity of ordinary furniture, we reach the space containing works of a more ambitious nature. We notice an extremely neat book-case, in oak and ebony, by Hubel, near which is a sculptured oak book-case, or buffet, which deserves a more detailed description. The base which projects in front, contains groups of objects alternated with bas-relief pannels, indicating severally the productions and symbolic attributes of Africa, Europe, America, and Asia. Above each is a figure emblematical of the particular continent. These figures are at the feet of columns dividing the shelf spaces above. The column above Africa is a palm encircled by an African climbing plant; that above Europe is an oak, encircled by ivy; that appertaining to America is a plaintain stem, encircled by an American parasitical plant; and that of Asia is an Asiatic tree, also encircled by a climbing plant. At the summits of the columns, and forming the cornice or crown of the subject, are allegorical groups of cupids, representing Water, Fire, Air, and Earth. The chief piece is a centre pannel, in bas relief, representing an assembly of the great men of the earth. The component parts of the design are so well wrought together, that a beautiful and complete whole is formed; and the effect would be perfect were not the figures in the centre pannel too minute and too crowded, but this is necessitated by the design. The author is P. Ribaillier of Paris, who has also a very beautifully carved chiffonier near the book-case. Beaufils of Bordeaux has also here a book-case, with very well designed and executed figures of the four quarters of the globe. Next, there is a very good carved wood case, by Weiber, Pitetti, & Co., followed by a simpler one by Klein. Gueret shows a very beautiful piece of carved wood—the subject, game—upon a fowling-piece stand and cabinet for sporting materials; he has also a pretty small book-case. A carved oak chimney-piece is exhibited by Rondillon, and a case for arms by Jules Fossey. The carved pieces we have noticed are scattered amongst a quantity of ornamental furniture, in much of which the wood is disposed with its grain inclined alternately to the right and left, according to the antiquated French taste, which we are surprised to see still adopted.

Having now completed the traverse of the outer circle of the panorama, we enter the central divan, which would present a magnificent *coup d'œil*, were it not spoilt by the sombre-canopied ceiling. In the centre of the space is a raised platform of two stages, crowned centrally by the case of resplendent Imperial jewels. Near these, on the lower stage of the platform, are the excellent electro-plate goods of Christolfe & Co., including a splendid service of one hundred covers ordered by the Emperor. The centre piece of this service is an allegorical composition, representing France distributing wreaths to the Hero of War, driving a war chariot, on the one side, and to Peace, in a chariot drawn by oxen, on the other; whilst near her are figures of Religion, Justice, Concord, and Force; and at a little distance are vases representing severally Northern, Eastern, Southern, and Western France. On the other side of the platform are the principal gems of the Sèvres porcelains; whilst several large vases from the same manufactory are disposed round the divan at points where their beautiful proportions add most to the general effect. One of the finest of these vases has its brim formed by Medusa heads, the snake hairs of which are intertwined to complete the contour Round the outer walls of the divan are some beautiful large paintings on porcelain, copies of celebrated oil paintings; and at the corner of one of the entrances is a small vase, or cup, six inches high, most beautifully ornamented by gilding, enamel, and jewels; it is by Duponchel, and is marked as sold. At another entrance corner are some ingots of the metal Aluminium; and there are also one or two cups and spoons of this metal on the centre platform. The descriptions we had seen of this metal led us to expect to find it brilliant, and resembling silver, but it is dull, and more like tarnished tin or zinc; possibly, however, the exhibited specimens are not perfectly pure. The lightness of the metal is marvellous. The walls of the divan are lined with magnificent specimens of the celebrated

Gobelins and Beauvais tapestries, and with the no less splendid carpets from Aubusson and Nismes.

This completes our account of the contents of the Panorama, and leaves us free to enter next month into the details of the long Annexe, in which our readers will doubtless find as much to interest them as in any part of the Exhibition.

THE MAGNETIC ADJUSTMENT OF MARINE COMPASSES.

By Mr. A. Small, *Broomielaw, Glasgow.*

(*Illustrated by Plate* 177.)

We need not carry back our memory far to recall but too many instances of some of the saddest fatalities arising from the faithlessness of the little bit of balanced steel, which, with a graduated card, guides the mariner over the trackless ocean. Sometimes, as in the memorable case of the *Tayleur*, these casualties occur within sight of home. At others, they treacherously surprise the sailor when far at sea he has no other means of steering into port. But come when they may, the derangements of the mariner's compass bring with them results so frightful, as to compel us to all alternatives rather than continue to sacrifice life to them.

What is called "local attraction," or the defective power which arises either from the casual presence of metallic bodies on shipboard, or from external circumstances, and turns the needle more or less from its true point, has produced many attempted remedies. The commonest appliance of this kind is the attachment of stationary external magnets, which, however, allow of no adjustment for the change of latitude or other more direct source of magnetic derangement. Mr. Small, formerly in the merchant service, and now Examiner to the Local Marine Board at Glasgow, has carried us beyond this stage, and has provided the nautical man with the means of adjusting his compass, with the greatest nicety, under all circumstances.

Fig. 1, on our plate 177, is an elevation of a ship's binnacle, as fitted up with Mr. Small's contrivances, one of the binnacle doors being open for the purpose of showing the internal details of the adjusting magnets. Fig. 2 is a sectional plan of the binnacle corresponding, showing the two adjusting magnets, as disposed at right angles to each other, one running fore and aft, and the other athwart-ship. Fig. 3 is an external plan of the binnacle complete. Fig. 4 is an elevation of another modification of compass binnacle, with the door open to show the internal arrangements, fig. 5 is an external plan of the same, and fig. 6 is a sectional plan, showing four adjusting magnets in position, two running fore and aft, and two athwart-ship.

In the modification represented in figs, 1, 2, and 3, the binnacle case or compass holder, A, is constructed according to the general form hitherto in use, the magnetic needle, or actual indicating compass, being contained in the cylindrical case, B, on the top of the wooden binnacle, and fitted with side reflecting lights, C, and an aft window, D, for the steersman to see by. The fore and aft adjusting or correcting magnet is at E, in the interior of the binnacle case, and the athwart-ship adjusting magnet is at F. Both of these magnets are fitted up in the same manner in every respect, as they are intended for effecting precisely similar objects, the direction of adjusting or corrective action only being different. Each of the magnets, E, F, is encased in brass, and it is attached, by its inner side to an adjustable retaining nut piece or holder, G H, through which nut the vertical screwed spindle, I, is passed. The nut holder is made to fit to the vertical groove or slot of the long metal guide-piece, J, attached to the side of the binnacle, and answering as well for holding the screw spindle. In this condition the adjusting magnets for both directions are retained in an accurate horizontal position, or at a true right angle with the longitudinal centre line of the binnacle. When the ship-master or his officer wishes to effect an adjustment of the compass needle, either in the fore and aft or athwart-ship line, he opens the corresponding door of the binnacle case, and shipping a handle upon the upper squared end of the proper screw spindle, he turns the spindle in one direction or the other, and thus elevates or depresses the corrective magnet, E or F, until the necessary corrective influence has been brought to bear upon the indicating needle of the compass. The set or vertical position of the corrective magnet is indicated by a vertical graduated scale, K, attached to the face of the inner portion of the binnacle. Thus as the magnet is raised or lowered, its upper edge points out upon this scale the exact position to which the adjustment has been carried, showing also the distance of the corrective magnet from the centre of the compass needle above. The top of the conical compass case carries a semicircular scale, L, graduated to degrees, before which is suspended the little index pendulum, M, so that whatever rolling inclination of the vessel occurs is at once pointed out, and the officer of the ship can then compensate by means of his magnetical adjustment, as hereinbefore described, for whatever deranging influence may thus be exerted upon the compass needle. The shallow cylindrical case, N, carries a "dumb compass card," clearly exposed to the eye of the steersman. It is swung on centres, O, athwart-ship only, and is fitted with any convenient circular adjustment, as a large wheel and thumb pinion, worm and worm-wheel, or other mechanical contrivance. When this dumb card is to be used, it is set round by hand, until its indications coincide with those of the real acting compass card of the magnetic needle beneath it. When this has been done, the vertical sight apparatus, P Q, is put to use for obtaining the sun's azimuth. This apparatus, P Q, consists of a short horizontal swivel arm, free to move upon a central stud carried by the dumb card, and having at its two opposite ends the hinged sight pieces, P Q, vertically slotted. These pieces, P Q, being turned up into a vertical position, as here indicated, by their bottom hinges, their carrying arm is turned round until the sun's azimuth is obtained, and the actual magnetic compass needle deflection is then found in the usual manner. As here indicated, the vertical hinged piece, Q, is graduated upon one edge of its slot, and over this slot is a hair-line piece, R, adjustable freely up and down. Thus the sun's light causes the index hair line to throw down its shadow upon the horizontal arm on the dumb card centre, and this arm being graduated, the sun's altitude is at once obtained.

In the modification of the compass arrangements, delineated in figs. 4, 5, and 6, there are four separate adjusting or corrective magnets, A, B, C, D, the actual indicating compass needle being in the case at E, in the interior of the body of the binnacle, and the steersman can see his compass card through the upper window, F, in the binnacle case. The respective corrective magnets in this arrangement are so set that two are near the top, and two near the bottom of the binnacle. The two opposite magnets are in this way at two different levels, as regards each other, the magnet, A, for instance, being at the lower part of the binnacle, and the magnet, C, at the upper part. The same relation is observed between the magnets B, D. The effect of this disposition is, that a corrective influence being exerted both above and below the compass needle, the derangement arising from the inclination of the ship is more fully counteracted. Each of the four corrective magnets is held in position by a traversing nut piece, as at G, the adjusting shift being effected, as in the former example, by the screw spindle, H. With this arrangement of four corrective magnets, the ship's officer has a more complete control over the indicating compass needle's deflections, as he can set or adjust on all four sides of the binnacle.

The plain top of the binnacle carries a semicircular scale and pendulum index, I, as in the previous example, for indicating the ship's inclination in the simplest manner. This binnacle is fitted up with a dumb card, J, as in the former example. On the centre stud of this dumb card is a horizontal arm, each end of which acts as a pointer for indicating north and south. The moveable centre on the dumb card carries a segmental or semicircular graduated scale, K, indicating the latitude. This segmental scale is graduated from the centre to each end to sixty degrees or more, indicating north and south latitude. This scale, K, carries an adjustable slide piece, L, having a vernier thereon, and capable of being clamped in any required position. This slide piece forms the support of a complete circular scale, M, or graduated dial, the graduations representing the hours and their subdivisions, and being on both sides and on the inner edge of the ring. The ring, M, has upon it a diametrical bar supporting a central slide, N. A small metal piece, O, is also attached to the ring, M, for the purpose of receiving the shadow when, from the position of the sun, it is lost upon the dial ring itself. This apparatus is most convenient and effective for showing at once the actual error of the compass needle, or the error occurring, irrespective of local derangement. Supposing the ship is sailing in north latitude, the dumb card is set, in the first instance, to correspond with the actual indicating compass. The slide piece, L, is shifted to the proper latitude, corresponding to the north point. The whole apparatus is then turned round until the shadow of the stile, N, falls upon the hour as indicated upon the dial ring, M, at which hour the observation is being made. Then the discrepancy found to exist between the north point of the dumb card, and the north point of the horizontal arm, gives the whole departure of the compass needle from the truth. It is obvious that this apparatus fulfils, in a more advanced degree, the office of the sight apparatus represented in the previous modification of binnacle. With a hair line fitted to the dial ring, the segmental scale acts as an eye piece to produce the same result as already described in reference to figs. 1, 2, and 3.

These improvements seem hardly to leave anything further for the mariner to wish for.

BIGELOW, THE AMERICAN INVENTOR.

II.

Before quitting his post at Lowell, Mr. Bigelow had projected a new manufacturing establishment at Lancaster for the weaving of ginghams. A company was formed, the required capital was promptly subscribed, and the projector was charged with the execution of the design. At the same time the Lowell Company resolved to build a large mill for the reception of their carpet power-looms, and Mr. Bigelow was commissioned to design and erect it. Both of these mills are of vast size, and in character perfectly unique. The one last named, with its two hundred iron looms, is, in fact, a grand carpet machine—the mill and its furniture being so combined, adjusted, and adapted, as to produce the most harmonious action and the highest results. The Lancaster mill is even more remarkable. Its connected structures, covering more than four acres of ground, are filled with machinery and apparatus of the most perfect character, much of which was invented or adapted, and all of which was arranged and adjusted, by Mr. Bigelow. Of this mill, the editor of the *Merchants' Magazine* says, "It is deservedly rated as the most perfect establishment in the United States." Of the dye-house connected with it, he speaks as "probably the most perfect in the world," adding, that "the entire arrangement is of the most perfect description, and in its vast completeness stands a splendid monument to the genius and masterly power of the mind of its projector." These immense structures, with their numerous, and various, and complicated machines, many of which were new, and nearly all of which were newly modified or adjusted, were carried on simultaneously, the working plans for the buildings and the machinery being furnished as fast as the work advanced. These plans, once matured, and put into the hands of the workmen, were scarcely in a single instance changed, and the loss in this way was exceedingly small—a striking proof of Mr. Bigelow's business talent, his constructive abilities, and far-reaching mental vision. Contemporaneously with these labours, he superintended important enlargements of the Counterpane Works, and of those belonging to the Coach-lace Company. Nor was this all. During the three years thus occupied, he made nine distinct, important, and patented inventions. It would have been strange, if, under a mental pressure so constant and intense, his health had not given way. Justly alarmed, at length, he fled from the toil and care which would soon have ended all. A voyage to Europe with his family, and a continental journey, completely restored him.

On his return, in 1848, he proceeded to develop and complete the Brussels Carpet Loom. The basis of this machine was indeed contained in the loom for coach-lace. But farther invention was needed to adapt it to the weaving of wider fabrics, to the making of figures that match, and to the formation of velvet-pile. This was fully accomplished. His power-looms weave rapidly and perfectly the Brussels and the Wilton, the tapestry and velvet tapestry carpets. They are competent, in fact, to every kind of looped and velvet-pile fabric known in the market.

In September, 1851, Mr. Bigelow took with him to England specimens of his Brussels carpet. Their appearance at the Exhibition, though late, drew much attention, and largely increased the favour with which the British public had already begun to look on the so long despised American Department. The juries having then closed their labours, no prize could be awarded to these fabrics. But in a supplement to the Report on Class XIX. we find the following:—

"The specimens of Brussels carpeting exhibited by Mr. Bigelow are woven by a power-loom, invented and patented by him, and are better and more perfectly woven than any hand-loom goods that have come under the notice of the jury. This, however, is a very small part of their merit, or rather of that of Mr. Bigelow, who has completely triumphed over the numerous obstacles that presented themselves, and succeeded in substituting steam-power for manual labour in the manufacture of five-frame Brussels carpets. Several patents have been taken out by different inventors in this country for effecting the same object; but as yet none of them has been brought into successful or extensive operation, and the honour of this achievement—one of great practical difficulty, as well as of great commercial value—must be awarded to a native of the United States."

The shrewd and practical manufacturers of England were quick to see, and prompt to acknowledge, the value of the new machinery. An arrangement was immediately made with Messrs. Crossly & Sons, for placing the looms in their immense carpet manufactory at Halifax. Subsequently these gentlemen purchased, and now hold, the patent right for the United Kingdom.

Previously to the introduction of Mr. Bigelow's inventions, power looms had scarcely been used for any but the plainest and simplest fabrics. These improvements cover the whole higher range of textile art. If we except such regal luxuries as the pictured tapestries of the Gobelins, there is no complex, or useful, or beautiful texture, produced by skill and patience in the hand-loom, to which his machinery has not been, or may not be, adapted. As compared with the plainer and more prosaic processes, this almost magical mechanism, and its results of endless and beautiful variety, may be called, not unaptly, the poetry of the loom. With such means at their command, and aided by the untiring arm of falling or of expanding water, our modern Penelopes are producing webs that rival the fabled labours of Arachne, with a rapidity which Pallas might have envied.

To appreciate the difficulties of this achievement, and the greatness of the success, one must keep in view the nature and demands of the weaving art. Each different fibre which it uses has its own peculiar properties, and whether it be cotton, or wool, or flax, or silk, the machinery must be adapted to those peculiarities. The number of fabrics which differ essentially in their texture is almost countless. To these considerations must be added, the constantly-recurring changes in figure and in colour required to meet a fickle taste and ever-varying demand. *He* must be a good arithmetician who can calculate the combinations required to produce, by automatic machinery, the numerous dissimilar fabrics which fill up the long interval between plain cloth and a Wilton carpet. More than all, perhaps, it deserves to be considered, that a power-loom for weaving tissues of the higher class, must have not only many and complex mechanical movements, but to a certain extent, also, the capacity of self-adaptation; an ability, in fact, to meet exigencies as they arise.

The extent of Mr. Bigelow's contributions to inventive art has often been misapprehended. Many think of him as the inventor of a single machine, the carpet power-loom, and suppose this to be all. It is a great mistake. The numerous and complex requirements of the textile art were not to be met by a single invention. Accordingly, Mr. Bigelow has, in this connection, twenty-two United States patents. Each of these is a distinct but necessary part in a closely-connected series of improvements, by means of which, under appropriate modifications, every variety of fabric may be wrought by power-looms.

It is difficult, by mere description, to impart a clear idea of mechanical movements. All that we shall here attempt will, we trust, be intelligible to any one who has ever seen a loom in action. The figure on coach-lace is formed by raising on the surface of the ground-cloth, a pile similar to that of the Brussels carpet. It is made by looping the warps over fine wires, which are inserted under such of them as have been selected by the Jacquard to form the figure. These warps are then woven into the body of the cloth. The wires are now withdrawn, to be reinserted. In the Bigelow loom this finger-work is executed by automatic pincers. There is something wonderfully cunning in the movement of these nippers. Seizing the end of the wire, they draw it out from the loops, carry it back towards the lathe, thrust it into what is called the open shed, and there drop it. The warp threads, which had been drawn apart, are now closed, and immediately reopened for the passage of the shuttle, which carries the woof to tie and bind the loops. The pincers having dropped their wire, return to take another. As it is necessary to have a number of these wires, and as they lie close together, a difficulty arose. It was clearly impossible to make the pincers so narrow, and so exact in their discrimination, as to seize the proper wire, and not molest its neighbours. This was avoided by a mechanical contrivance on the other side of the loom, which, just at the right moment, gives a little push to just the right wire, and thus puts it in just the right place for the waiting pincers. The curious mechanism by which these little rods are withdrawn and replaced, must work, it is evident, in perfect harmony with that which forms the figure.

The loom for Brussels and tapestry carpeting is the coach-lace loom full grown. Nothing short of actual inspection can give any just idea of its wonderful capacities and life-like action. Wires three feet or more in length are here inserted and withdrawn, with a precision and quickness which no manual dexterity ever attained. Let us watch the operation. First, mark that intruding knife or wedge, which, as it rises, separates from its companion the wire next to be taken, and guides the pusher, which shoves it along towards the pincers. The pincers now walk up, grasp the wire, and draw it entirely out. While this is doing, another set of nippers, hanging down like two human hands, come forward, descend, and catch the wire at the moment when the drawing-pincers drop their prey. No sooner have they seized the wire than they retreat to their original position, beneath which a small angular trough has just arrived. The fingers relax, and the wire drops into the trough, which immediately returns. Last of all a triangular pusher, rushing through the trough, sends the rod into the open shed. Note, also, the double action of the withdrawing pincers, which, while they attend to their own special mission, perform also sergeant's duty, by constantly bringing into line the straggling wires. Those bird-like, three-fingered claws, which dart back and forth with such rapidity, are busy in plaiting the selvedge, and their work is perfect. These, too, are "contrived a double debt to pay," for, whenever their thread breaks, they instantly stop the loom. In this loom, and that for coach-lace, the mechanical contrivance for weighting the warp threads is the same, being one of the most ingenious, as well as most important, of Mr. Bigelow's improvements.

What is this remarkable process which we call *invention?* How does the brain act while devising its wonders of mechanic skill? These are questions of interest to inquiring minds, and may well puzzle those to whom even the witnessed action of complicate mechanism is a mystery impenetrable. By some it is supposed to be a sort of hybrid process—a result in which chance and calculation are about equally concerned. Accident has doubtless, at times, had something to do with it. The slightest incident may start the train of thought which shall lead to some great discovery or invention. But in that train of thought there is nothing random or accidental. The mathematical element must, of necessity, figure largely. Yet in the mental series it is not first in order, nor is it, in fact, more essential than another faculty seldom associated with our ideas of machinery. The great mechanical inventor is, perhaps, the only person who compels the Mathematics to wait upon the Imagination. This power, and this alone, can supply him with the *means* of accomplishing his purposes. For the effectual use of these means be depends on the science of number and quantity. That this substantially was the process in those inventions to which our attention has now been turned, appears from the following answer of Mr. Bigelow to an inquiry on that point:—

"I am not sure that I can convey to your mind a satisfactory idea of the inventive process in my own case. One thing is certain, it is not chance. Neither does it depend, to any great extent, on suggestive circumstances. These may present the objects, but they are no guide to the invention itself. The falling apple only suggested to Newton a subject of inquiry. All that we know of the law of gravitation had to be reasoned out afterward.

"My first step toward an invention has always been to get a clear idea of the object aimed at. I learn its requirements as a whole, and also as composed of separate parts. If, for example, that object be the weaving of coach-lace, I ascertain the character of the several motions required, and the relations which these must sustain to each other, in order to effect a combined result. Secondly, I devise means to produce these motions. And, thirdly, I combine these means, and reduce them to a state of harmonious co-operation.

"To carry an invention through its first and second stages is comparatively easy. The first is simply an investigation of facts; the second, as far as I can trace the operations of my own mind, comes through the exercise of the imagination. I am never at a loss for means, in the sense above explained. On the contrary, my chief difficulty is to select from the variety always at command those which are most appropriate. To make this choice of the elementary means, and to combine them in unity and harmony—to conduct, that is, an invention through its last or practical stage, constitutes the chief labour.

"In making this choice of the elementary parts, one must reason from what is known to what is not so; keeping in mind, at the same time, the necessary combinations, examining each element, not only in reference to its peculiar function, but to its fitness, also, for becoming a part of the whole. Each portion must be thus examined and re-examined, modified and remodified, until harmony and unity are fully established. From the severity of this labour many inventors shrink, and this is the main reason why some very ingenious men fail to obtain satisfactory results. In my own case, the labour has not ended with the perfection of my looms; other machines, preparatory and auxiliary, were necessary to give full effect to the inventions.

"It is a well-known fact, complex inventions have not, as a general thing, come at once into use. In many cases this has been because they were not immediately brought into harmony with other things. In a state of natural progress, things move on together, and become mutually adjusted. An important invention often disturbs these adjustments, and cannot be made to work efficiently until other inventions and new arrangements have brought all the related processes in accordance with it. This arduous duty I have endeavoured to perform for all my looms. Lee's band-stocking-loom was invented several years before it was reduced to practice, and even this was not effected by the inventor. The comparatively simple power-loom for weaving plain cloth was of very slow growth. A long time elapsed before its organization was so far harmonized as to work at all; and, for several years afterward, successive improvements only gave to it a moderate speed. Its capacity, in this respect, has actually been doubled within the last fifteen years. If my own more complex machines, for the production of figured fabrics, have attained at once to a high state of perfection, I attribute it, in part, to the fact, that my attention has also been given to those processes which are subordinate, preparatory, and collateral, and that these have been made to accord with the main invention. That this claim of success is not extravagant will appear, I think, when it is considered that the cost of weaving coach-lace was, at one stride, reduced from twenty-two cents to three cents a yard, and that of Brussels carpet from thirty cents to four cents. Of the fabric last named, my power-loom, under the easy tending of a single girl, produces from twenty to twenty-five yards daily, and this of the best quality. That mechanical possibilities do not reach much farther in this direction will be conceded, probably, by all who are acquainted with the peculiar character of the process.

"I find no difficulty in effecting that concentration of thought which is so necessary in pursuits like mine. Indeed, it is not easy for me to withdraw my mind from any subject in which it has once become interested, until its general bearings, at least, are fully ascertained. I always mature in my mind the general plan of an invention before attempting to execute it, resorting occasionally to sketches on paper for the more intricate parts. A draughtsman prepares the working drawings from sketches furnished by me, which indicate in figures the proportion of the parts. I never make anything with my own hands. I do not like even drawing to a scale."

It has become almost a proverbial remark, that great inventors seldom reap the fruit of their ingenious toil. This has happened, not merely from the fact referred to above, that they had failed to perfect their inventions, by meeting, as they ought, the new demands which their own improvements had created, but also because they have too frequently been inventors *only*. Absorbed in their own pleasing projects, neglecting to avail themselves of what they have actually accomplished, in their ardent zeal to achieve something greater, they leave their rights unsecured, or suffer them to slip out of their hands. They labour, and other men—far inferior men—enter into their labours. To this rule, if it be one, Mr. Bigelow is a striking exception. He is no dreaming genius, who needs a guardian to protect his rights and manage his affairs. He is as much at home in matters of business as among the wheels and levers of his looms. Several of his most important contracts, drawn wholly by himself, have commanded the admiration of acute lawyers. More than once his patents have been invaded, but in every case the offenders have yielded, either to his prudent firmness, or to the strong arm of law. In a single instance—and then through the negligence of a legal agent—he failed to obtain protection in the English Patent-office, for some important principles. It was a serious injury.

In the ingrain-carpet power-looms of the great mills at Lowell, about thirteen hundred thousand yards are made annually. The same fabric is woven in large quantities by companies at Tariffville and Thomsonville, Con., whose power-looms are worked under license from the Lowell Company. Messrs. Higgins & Co. are using the Bigelow looms for tapestry and velvet-tapestry carpets, in their establishment in New York. Another company in Troy, N.Y., is weaving the same article under license from Mr. Bigelow. At Humphreysville, Con., several looms are now employed in the manufacture of silk brocatelle. Mr. B. adapted and constructed the machinery for this beautiful fabric in 1851. Goods for which the hand-loom artisans of Lyons get three francs a yard, are made here at a cost for labour of fifteen cents. a yard. The agent, Mr. Humaston, is entitled to much praise for the skill and perseverance with which he has brought these works into successful operation.

In 1849, Clinton was made a township by legislative act. In 1837, when the brothers Bigelow went to this spot, that they might use one of its brooks in operating the coach-lace loom, it was the least cultivated and least valued part of the old and beautiful town of Lancaster. At that time it contained some two hundred inhabitants; it has now about four thousand. There may be seen the great gingham mill, already named, producing annually nearly five millions of yards; the counterpane mill, which turns out yearly one hundred and fifty thousand dollars' worth of goods; the establishment of the Clinton Company, where two million yards of coach-lace, tweeds, &c., are woven; and that of the Bigelow Carpet Company, belonging to the two Bigelows, and to H. P. Fairbanks of Boston, the daily results of which are a thousand yards of Brussels and Wilton carpeting. The amount made by this single establishment, now only three years old, is equal to the entire importation of Brussels carpet from England, at the time when the works were started. Though these looms run night and day, they are inadequate to the constant demand.

We have seen with admiration, on both sides of the ocean, many a village and city which owed their prosperity, if not their existence, to the genius of modern manufacture. But to us there is a charm in Clinton, which belongs to no other place of the kind. As from those gentle, woody heights, we have surveyed its monuments of ingenuity, wealth, and enterprise—its numerous evidences of industry and thrift—its pleasant homes of competence and content—its institutions for learning and social improvement, and its neat temples reared for God—all of it the magical creation of a few short years—the spectacle certainly lost none of its interest because we could trace it directly to the efforts of a single mind. Clinton, with all its actual and its prospective importance, was assuredly predestinated in that abode of honourable poverty, those hours of toil and vigil, and that filial love, which gave birth to the coach-lace loom. Happy he who may thus behold around him the good which he has done! While scattering "plenty o'er a smiling land," he plants also, in good ground, the blessed seeds of individual and domestic happiness, of social progress, of education, and morals, and religion.

It would be a great injustice to omit, in this reference to Clinton, one who deserves to be called its twin founder—Horatio N. Bigelow. At the very outset, while success was yet uncertain, when he was himself poor and struggling, he gave pecuniary aid to his brother in the patenting and building of his inventions. All the mills in Clinton were started by him, and two of them are still under his management. To his skill, industry, and business talent, much of their success is undoubtedly due. It is not easy to estimate the advantage derived by the inventor from so able and so faithful an execution of his plans.

Mr. Bigelow's father, for whose sustenance and comfort he gave up his own cherished schemes, and devoted himself to invention, after aiding his son in building the coach-lace loom, died, much to the son's regret, just before its success was made certain. His mother, not yet very far advanced, lives to share the prosperity and affection of her sons. He has been twice married. His first wife died early, leaving an infant child. This boy, of much promise, survived his mother hardly seven years. His present wife is a daughter of the late Colonel David Means, of Amherst, N.H. They have one child, a daughter.

Mr. B. is a man of middling stature, and slightly inclined to roundness. The lineaments of his face and head are such as one might look for after hearing his story.

The individual, whose well-directed labours have not only gained for himself reputation and fortune, but furnish employment and support to many thousand persons, while they save annually for his native land millions of dollars, is still under forty years of age. With such power of intellectual analysis and combination, such energy and persistency of purpose, he cannot yet have discharged the debt which he owes to his country and to mankind. That he still intends to devote himself to the advancement of industrial art, in all its interests, moral and material, we have the best reason to believe.

INDIA RUBBER SPRINGS.

By Mr. W. C. Fuller, Bucklersbury, London.

(*Illustrated by Plate* 178.)

The application of caoutchouc, or india-rubber, in the form of cylindrical rings, acting under compression, has already met with two illustrated descriptions at our hands.* Such springs have been largely used both for marine and carriage purposes. For the heavier class of carriages the compressive action springs have answered exceedingly well; and, besides being used for private carriages, they have been adopted by the government for all kinds of military transport vehicles, gun and ammunition carriages, and Flanders and store waggons. We have now to deal with this curious and certainly invaluable substance in its suspensory applications, and as especially fitted for the higher class of carriages, for which, if successful, there is a wide and varied scope of adaptation. The array of contrivances now displayed by Mr. Fuller comprehend new modes of construction; various plans and details of application; suspensory shackles for the ends of steel springs; the insertion of india-rubber springs for preventing an injurious recoil action in fire-arms; and a similar adaptation for obviating jars in crutches and artificial legs.

The idea of the suspensory action of india-rubber is not in itself a novelty. It has indeed been often practically attempted; but success has only partially smiled upon these efforts, so that we are virtually breaking new ground in discussing the subject here. Considerable practical difficulties have all along presented themselves, even when theory had apparently settled the whole matter; and it has been by careful and repeated experiments that the position which we now illustrate has been slowly reached.

Carriage building—more particularly in its higher grades, including the important detail of springs—has, in our times, become a science; and although the admirable properties of india-rubber as a spring, especially in the suspensor form, are so palpable as to have often occurred to every one interested in the subject, it will be seen at once that the real difficulties lay in the way of the practical development alone.

Mr. Fuller professes to have overcome all or most of these barriers to progress. With a raw material, prepared expressly for securing great strength and elasticity, unvarying under extreme thermal changes, he has taken care to keep all the bearing points of the springs clear of friction, getting, at the same time, considerable supporting power within a limited bulk. He protects the spring material by a corrugated leather cover, acting as a check for the extreme distance, and giving an ornamental exterior to the comparatively shapeless mass; and by a new arrangement of the axle, he secures it in its position, whilst sufficient ease of motion is gained in every direction.

In illustrating this invention in its practical form, we have selected sixteen varieties and views, as actually made, and now in use. These form our Plate 178. Fig. 1 is a front, and fig. 2 a side view of one of the springs, denuded of its cover. Each end is fitted up with a transverse metal socket, A, for the retaining studs of the elastic material, which is composed of a set of india-rubber rings, B, stretched over the end sockets, and secured by diagonal and transverse bindings of tape or cord. Previous to binding up the ends in this way, the elastic material is stretched by proper machinery to its utmost working extension, so that when the ends are secured, no frictional working can ever occur at these parts, as the spring action is entirely restricted to the central portion. When a check is to be used for settling the extreme working distance, the necessary effect may be produced by adding an elastic webbing or cord, or a combination of india-rubber and cloth or canvas inserted in the body of the spring. The external covering of the spring may obviously be applied for a similar purpose; and the body of the spring may be composed of thin sheet india-rubber band or tube, secured either by cords, or by screw-plates. When rings are used, as in figs. 1 and 2, they are preferred to be from 2 to 2¾ inches internal diameter, and ⅜th inch thick. Such rings, when extended to double their natural or normal length, will carry 20 or 26 pounds.

Fig. 3 is a side elevation of a duplex carriage spring of this kind, as contrived for producing a considerable horizontal tension between the axle and the scroll-irons, right and left. In this arrangement the axle is held in position by the spring itself, whilst there is a certain amount of free lateral action to give greater ease to the vehicle. There, C, is the carriage-axle, upon which is fixed an ornamental stay-iron, like an ordinary steel spring. Each end of the stay-iron has jointed to it an india-rubber spring, D, the opposite ends of which springs are similarly jointed to the scroll-irons. This spring possesses extraordinary susceptibility, with a freedom from vibration; and its horizontal position affords the necessary perpendicular action with the least possible friction upon the material. Fig. 4 represents a spring precisely similar, except that it is fitted with a single elliptic stay scroll-iron. The front spring may be a strong inelastic leather strap, or "dumb-iron," suiting it for a pony phaeton, or the front of a Brougham, where double elliptics are used. A stronger spring of a similar kind may be made with an inverted elliptic stay scroll-iron, which, being fixed at both ends, takes the strain from the carriage body. The flat stay-iron, with a spring at one end and a dumb-iron at the other, is contained within the ellipse, having adjusting nuts at the ends. Fig. 5 is an elliptic bow spring, in which the lateral tension is obtained by two india-rubber springs, E, whilst the perpendicular action is upon the diagonally disposed springs, F. Fig. 6 represents an arrangement suitable for omnibuses. The back stay-irons keep the axle firmly in place, and the weight is partly sustained in front. Fig. 7 is a compound spring arrangement, in which the axles, G, are retained in position by a light metal perch, H. The front axle has a metal clip with a socket, through which the end of the perch is secured by a bolt, in such a manner, that the axle may work freely round. The body and under carriage are connected by a wheel-plate in the usual manner, and the whole of the parts are then attached to the axles by the four springs, I, represented in the figure. Fig. 8 is a railway carriage spring, fitted with Mr. Fuller's earlier india-rubber rings, which are well fitted for sustaining great weights. The axle-guard, or horn-plate, J, is fitted with a grooved sliding bearing box, K, upon which is bolted a stay-iron, L, formed like a steel spring, and either straight or slightly curved. An elliptic stay-iron, M, is bolted to the under side of the carriage frame, being also secured by its centre to the under side of the axle-guard. The spring shackles, N, by which the carriage is suspended to the extreme ends of the stay-iron, are fitted with india-rubber rings, as shown in fig. 9 in enlarged detail. The necessary initial spring tension is obtained by screwing up the elastic rings more or less, as the case requires. The arrangement shown in fig. 10 is similar in principle, but fitted with suspensory springs, O. The central stay-iron, P, is bolted to the top of the axle-box, and has jointed to it fore and aft connecting links, Q, the extreme ends of which are secured by nuts to the elliptic stay. Elastic washers, R, are fitted on at the junction with the elliptic stay, so that any desired lateral tension may be got up by adjusting the nuts to suit. This setting holds the axle firmly in position, allowing, at the same time, a verticle movement of 1 or 1½ inch. The suspensory springs, O, which may be made to support a ton, form the vertical communication between the stay-iron, P, of the bearing and the bottom of the elliptic piece. Fig. 11 is a spring suited for an omnibus, or a carriage for heavy loads. The chief peculiarity in this spring is, that the india-rubber rings, S, are more numerous and thicker, so as to afford a greater verticle action. The elastic rings, also, are disposed outside the elliptic stay-iron, and they work against an oscillating hinged plate, giving greater freedom of action. Fig. 12 is another omnibus or van spring, with vertical axle-box guides, between which a suspensory spring, T, is stretched tightly across. This spring is connected by a central ⊤ piece, with the axle-plate, U, sliding upon the guides. This is a compact, powerful, and sensitive spring. Fig. 13 is an example of the adaptation of india-rubber springs as shackles for the ends of steel springs; and fig. 14 is a detail of the shackle. The shackles are formed by winding a continuous vulcanised india-rubber cord round a pair of metal sockets, V, placed nearly in contact with each other. The elastic cord is wound on at considerable tension previous to being tied down, so as to provide for several hundred-weights of elastic power to begin with. When applied to a steel spring, as at W, concentration and power are combined with great neatness of appearance, whilst the elastic material is well protected. Fig. 15 is a detail of another spring-shackle, capable of being applied in this way to steel springs with common junction eyes, and to cross springs.

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* Page 153, Vol. VI., and Plate 176.

Fig. 16 is a side view of part of a musket or rifle, fitted with Mr. Fuller's recoil springs for the shoulder action. The end of the stock is fitted with a metal heel plate, X, answering as the holding socket for the elastic india-rubber rings, Y. This plate has a central pin, fitting a hole bored in the solid end of the stock, as a guide. The spring rings, Y, are also carried on guide-pins fast in the plate. This forms a good end buffer to counteract the recoil or "punch," which, in a long range rifle, is somewhat formidable.

The adaptation of india-rubber springs to artificial legs and crutches is effected either upon the compression or suspension principle. In the common wooden legs of the army and navy the leg-socket is fitted to the plain leg-stem, with an interposed ring of india-rubber to act by compression as an elastic deadener. In crutches, a convenient arrangement is to apply a suspensory spring to the arm portion, thus materially improving the crutch action, and doing away with the dead rigidity which a crippled man feels with the common solid inelastic support.

The continued industry of Mr. Fuller has given us many other varieties of spring actions on the broad principle of what we have here outlined. The results are, in the whole, a valuable contribution to our mechanical resources.

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RECENT PATENTS.

FIRE-ARMS AND AMMUNITION.

Captain J. Norton, *Dublin.—Patents dated Feb.* 23 *and March* 8, 1855.

In these two patents Captain Norton makes two important additions to his already extensive stock of contrivances appertaining to fire-arms. The first patent relates to the so arranging and manufacturing cartridges for fire-arms of various kinds, that the explosive discharge may be effected without the necessity of first piercing or breaking open the paper case of the cartridge, as is usual with the existing arrangements—the explosive discharge being produced by the heat or flame derived from a common or military percussion cap. For this purpose percussion powder or gun-cotton is incorporated with the cartridge, or explosive charge of gunpowder, in such manner as to afford a more certain and effectual means of ignition than is obtainable with ordinary gunpowder. In making or fitting up cartridges in this way, under one modification, a piece of thin tough paper, sufficient to form the entire case or cartridge, is laid on the mouth of the mould or shaper, the bore of which is of the same size as, or rather of a size smaller than, that of the arm for which the cartridge is to be made. This paper blank is then pressed down into the mould, so as to form the case of the cartridge, with its upper end open. A small portion of percussion powder, or gun-cotton, is then put or pressed into the bottom of the paper case, and the required charge of gunpowder is then poured in over the percussion powder, or gun-cotton. The ball or shot is then pressed on the gunpowder, and the open end of the paper case is tied in front and behind the ball or wadding.

Fig. 1.

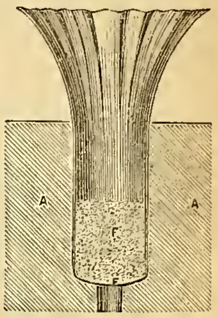
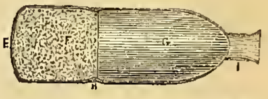


Fig. 1 of the engravings is a sectional view representing the open cartridge case as charged with detonating or percussion powder at the bottom, and with the firing charge of ordinary gunpowder above this bottom explosive layer, and fig. 2 is a sectional view of the completed cartridge, with its front end tied up, the cylindro-conoidal shot being in elevation. In fig. 1, A is the mould for giving the cylindrical contour to the cartridge case; B is the case paper in the act of being brought to the required form with the "former," or ramming stick. The cartridge paper, cut to the proper size, and either round or square in shape, is first of all laid down upon a table or other convenient flat surface, and the actual moulding or ramming end of the "former" is then placed upon the centre of the paper. At this stage of the operation, the sides of the paper are drawn or folded up on the former in a lose manner, and in this condition the covered in end of the "former" is entered with the paper, into the open end of the mould, A. This action necessarily brings the cartridge paper to the form represented in fig. 1; the lower part, B, of the paper being compressed to a cylindrical form, with the solid bottom end slightly convex, whilst the upper part, D, of the paper is loosely expanded. The "former" is then withdrawn from the mould, leaving the paper therein, in the form of a hollow open topped case. This case is now ready for the reception of the fulminating mercury, or percussion powder, E, which is dropped into the bottom of the case, forming a thin layer thereon. After this, the proper charge of ordinary gunpowder, F, is put into the case; above the fulminate, and over both these explosive substances, is placed the cylindro-conoidal shot, G—the cylindrical base of the shot being passed down into actual contact with the gunpowder. A thread or string, H, is passed round the cartridge at the shot's base, and between the latter and the gunpowder, and the paper in front of the shot is well and tightly tied up over the shot's apex at I. The thread at H gives firmness and solidity to the cartridge, and prevents shaking, whilst the front end tie insures the unburnt portion of the cartridge case being carried clear of the gun's barrel with the shot when fired. Instead of fulminating mercury or percussion powder, a very thin paste of the fulminate may be spread upon the centre of the cartridge paper blank before folding—this coating being somewhat larger in diameter than the diameter of the shot's base. If gun-cotton is used as the explosive medium, in place of the fulminating matter, E, a thin layer of the gun-cotton is placed in the bottom of the case, so as to occupy the space marked E. The patentee prefers, however, to use fulminating mercury instead of gun-cotton for this purpose. But he also makes his improved cartridges with gunpowder alone, using no other explosive agent within the cartridge case. When gunpowder alone is thus used, he makes a very fine and hardly visible puncture through the centre of the base of the cartridge case—this puncture being covered or closed up by a slight varnish, or composition, which yields to the heat of the percussion cap flame from the nipple of the gun. When the cartridge is made in this way, not even the finest grain of gunpowder can escape from the cartridge case, whilst the percussion cap fire, striking the base of the cartridge case centrally, is certain to explode the cartridge.

Fig. 2.



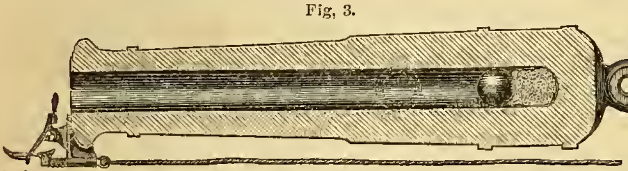
Cartridges of this improved kind, when finished to the form and arrangement represented in fig. 2, are most conveniently available for all classes of fire-arms; the user being saved from all trouble with them further than that involved in seeing that the explosive base of the cartridge is placed next to the gun's breech, as the case requires no breaking open or preparation whatever prior to firing. Such cartridges are more especially serviceable for "breech loading" arms, as, when they are simply laid in the open breech of the arm, it is obvious that the fulminate in the base of the cartridge can never receive any objectionable shock to cause risk of premature explosion. But when gunpowder alone is used, the cartridges may be rammed down the muzzle of the fire-arm without the slightest danger.

If the base fulminate priming is used in either of the ways pointed out, various kinds of explosive priming matter may be employed. For example, a mixture of equal parts of chlorate of potass and sulphuret of antimony may be so used instead of fulminating mercury.

The invention covered by the second patent is designed to obviate the rendering pieces of ordnance useless by the enlargement of their touch-holes—a defect so frequently complained of in the present war. The desired object is effected by so arranging the ammunition and the discharging or explosive apparatus, that the discharge may be effected from the muzzle of the gun. In carrying out this system of firing, a spring movement is fitted up at the muzzle or mouth of the gun, and is made to act upon a "Vesuvian" match, or other similar ignition contrivance, in such manner as to direct a shower of strong sparks down the muzzle to the bottom, or towards the breech of the gun, where a few grains of loose gunpowder catch the sparks and fire the charge.

The engraving, fig. 3, is a longitudinal section of a gun, or piece of ordnance, as detached from its carriage or mounting, and supplied with the improved explosive or discharging apparatus. The gun, which may be made according to any of the existing forms or systems of construction, has no vent or touch-hole at the breech, the only opening into it being that of the barrel or discharging bore from the muzzle to the breech. To the lower side of the extreme muzzle end is attached a bracket piece, answering to carry the new discharging apparatus. This bracket has a front projecting arm, for carrying the spring lever match holder. This spring lever is set upon a stud centre in the bracket arm, and it is fitted with a coiled spring, so adjusted as to give the upper short arm of the lever a constant tendency to turn over towards the gun's muzzle. Various spring arrangements may be adopted for this purpose; but such a volute spring as is generally fitted up for spring letter-clips or holding files; or a sharp blade spring may be judiciously applied for this purpose. The upper short arm of the match-holding lever is formed to answer as a socket for the reception of the tail of the "Vesuvian" match, the explosive or combustible head of which stands up to about the level of the longitudinal centre or axial line of the gun. The lower longer arm of the holding lever is notched or formed with a retaining edge, to fit to a retaining notch on the outer end of the disengaging catch or trigger. This trigger is hinged upon a stud centre, on the upper side of a sliding spring spindle, which spindle is fitted to slide by its after end, in a long plain guide eye, on the lower part of the bracket. The guide eye is bored right through, and the inner or after end of the sliding spindle, which is passed through it, has an eye to which is attached the gunner's discharging cord, passing back beneath, or alongside of the gun to the station of the gunner, so as to be convenient to his hand. The sliding spindle has upon it a helical spring abutting between the front extremity of the bracket guide eye, and the small front projection on the spindle carrying the stud centre for the trigger. The trigger is a double lever, having a short curved after part projecting past its centre of motion. This short end of the trigger has a slight blade spring fitted to its under side, so as always to keep the longer arm down, and thus retain its detaining catch in gear with the notch upon the lower arm of the match-holder. The release of the detent is effected by an incline upon the bracket, against which the tail of the trigger is pressed when the gun is fired. The charge of powder is applied and placed in the gun in the usual manner; but a few grains of powder are sprinkled in front of the shot, in communication with the main body of the charge. Hence if this internal priming, as it may be termed, is ignited, the fire is communicated to the main charge behind the shot, so as to complete the discharge. Thus, no other preparation for firing is required.

Fig. 3.



The drawing represents the discharging apparatus as cocked, or set fully ready for firing, the ignited match being held steadily back by the trigger detent. When all is ready for firing, the gunner jerks the cord, when the tail of the trigger, being drawn forward along with the sliding spindle, strikes against the incline of the bracket. This action necessarily elevates the front detaining end of the trigger, and thus releases the spring lever match-holder, which has had its tail or longer arm drawn forward to some distance, so as to add effect to the reacting power when released. The Vesuvian match having a tuft-like or conical head of combustible matter, as in the case of an ordinary cigar lighter, the shock resulting from the sudden release of its spring holder, causes the match tuft to throw off a thick shower of fiery sparks, sending them right down the gun's bore, so as to reach the scattered powder in front of the shot, and thus fire the charge as already explained.

Various other mechanical arrangements may be adopted for effecting the throwing in of this explosive shower of sparks, as all that is necessary is to fit up a spring, or "balistic," or mechanical contrivance which, when disengaged or put in action, will discharge a shower of fire well into the gun's bore. The spring arrangement which has been described supplies a most effective means of directing the fire, and greater effect may be given to the spring action by attaching an india-rubber band to the lever movement, whilst the Vesuvian match promises a good supply of sparks, although other matches or sources of fire may be used. Instead of the scattered powder in front of the shot, a match or other combustible matter may be laid in, so as to afford a proper channel of communication from the open barrel to the charge behind the gunpowder. By the adoption of this system of discharging firearms, particularly those of large calibre, all the trouble, difficulty, and loss of discharging force attendant upon the vent or touch-hole system are avoided. There being no vent to blow out or widen, no repairs can ever be required at that part of the breech, nor can miss-fires occur from the vent thoroughfare closing up.

ADJUSTABLE VICE.

W. A. Henry, *Sheffield.—Patent dated May* 29, 1855.

This invention, which is being worked out by Messrs. Marchinton, Brothers, of the Bruce Works, Sheffield, relates to the improved arrangement of vice which we have delineated in the accompanying engravings, fig. 1 being a side elevation, and fig. 2 a plan. In this vice, the stationary jaw, A, is held by the upper and lower brackets, B and C, fixed to the bench. The upper bracket, B, is made to grasp a rounded part of the jaw stem, and is tightened upon the latter by means of a pinching screw. The lower part of the jaw stem is screwed and is passed through an eye in the bracket, C, being adjusted and held in position vertically by nuts screwed upon it above and below the bracket. The moveable jaw, D, is made with a round stem, and is capable of a swivelling action in a socket piece, E, so as to adjust itself to tapered objects in the manner indicated in fig. 2. The socket piece, E, is jointed to a stout bar, F, capable of sliding through a box, G, formed upon the stem of the stationary jaw, A. This piece, F, is made by sliding to carry the jaw, D, in or out, so that it may be as nearly parallel as possible to the jaw, A, whatever the size of the object between them may be. The slide, F, is held in any position by means of a row of ratchet teeth on its upper edge, into which a pall, H, is made to engage, and it is shifted in or out by means of a scroll piece, I, working on a pin on the box, G, and actuated by the handle, J, on the other end of the axis, passing through the slide, F, and on which the scroll is fixed. The screw, K, by which the jaws, A and D, are brought together, is made to enter a box, L, on the back of the jaw, A, and is thereby kept free from dust and filings. When the screw, K, is released, the jaws, A, D, are separated by the action of the blade spring, M, which presses against a pulley, N, carried by the slide, F, so as to act equally well at whatever distance the jaw, D, may be from the jaw, A.

Fig. 1.

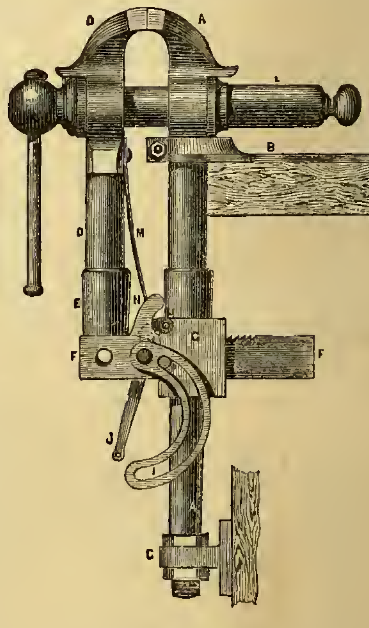
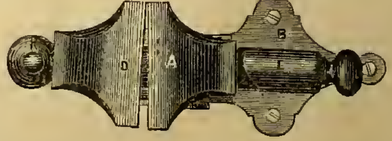


Fig. 2.



We are sure that the many conveniences of adjustment exhibited by this vice will be duly appreciated by practical workmen.

BOTTLE STOPPERS.

R. Pinkney, *London.—Patent dated September* 23, 1854.

Mr. Pinkney's stopper is contrived so that the flow of the liquid from the bottle to which it is applied may be regulated with the greatest nicety.

Fig. 1.

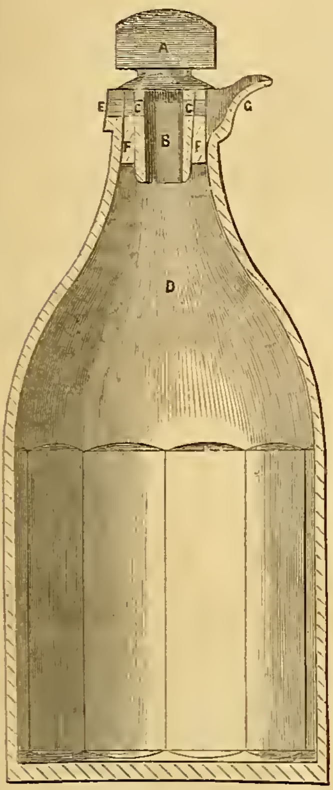
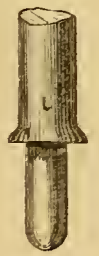


Fig. 1 of our engravings is a vertical section of an ink-bottle, as fitted with the improved stopper. The stopper, A, which may be composed of glass, stoneware, metal, or other material, is tubular, being bored up at B, from its inner end to within a short distance from the handle portion. In this tubular portion there are formed two lateral perforations, C, represented as being diametrically opposite to each other, although such an arrangement is not absolutely necessary, as they may be made at a slight angle to each other, and at different levels, if desirable. The neck of the bottle, D, is formed with a lateral opening or slot, E, corresponding with the lateral perforation, C, in the stopper, when the latter is in its place, the material being strengthened by a lip round the slot, to prevent fracture in cutting the slot. In bottles fitted with a pouring lip or spout, as shown in the figure, an inner stopper collar-piece, F, composed of cork or other suitable material, is fitted into the neck, and is then perforated longitudinally to receive the shank of the stopper. Transverse perforations are then made laterally, to correspond to the lateral perforations, C, in the stopper. In using this bottle, it is merely requisite to turn the stopper partially round, to bring the respective holes into or out of correspondence, to open or shut off the flow from the bottle. When the out-flow passsage is closed, the blank perforations in the stopper are opposite to the solid portions of the neck, but, by a slight turn, the lateral perforations, C, in the stopper, are made to correspond with the lateral hole or slot in the neck and cork, thereby allowing the external air to find its way through the tubular portion, B, of the stopper, and thence down into the bottle, so that the ink or other liquid may flow freely. The ink similarly finds its way out up through the tubular portion of the stopper, and thence, through the aperture, C, into the pouring lip or spout, G.

Fig. 2.



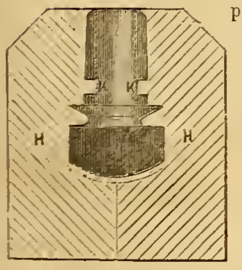
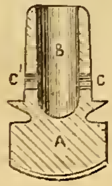


Fig. 3.

The apparatus for manufacturing these stoppers is represented in figs. 2 to 8. Figs. 2, 5, and 6 are elevations of the lower portions of three forms of plunger die for making the stoppers. Fig. 3 is a vertical section of the corresponding metallic mould or matrix; and fig. 4 is a vertical section of a stopper, as made by the details represented in figs. 2 and 3. Figs. 7 and 8 are plans of the stoppers produced by the plunger dies, figs. 5 and 6.

Fig. 4.



The mould, H, is formed in two parts, on the interior of which, and corresponding to the lateral holes in the stopper, are two circular or other shaped projections, K. The circular plunger, J, for forming the hollow of the stopper, just touches the ends of the projections, K, in its descent into the mould, thereby clearing, or partially clearing, away the material between the sides of the plunger and the ends of the projections, K, as shown by the dotted lines, and consequently leaving an aperture in each side of the stopper; or, if not formed quite through, the aperture may be easily completed by pushing out the thin film of glass remaining in the inside of the perforation. By this arrangement, the stopper is formed at one stroke of the plunger, and the expensive process of drilling is entirely avoided.

The plunger represented in fig. 5 is divided in two portions, the glass or other material rising between, and forming a division in the stopper, as in fig. 7. Fig. 6 represents another plunger, with a projecting piece all round lengthways, forming a corresponding groove in the hole of the stopper, in which a slip of wood, glass, or other material may be fitted, and held secure, thus dividing the tube in two portions, as in fig. 8, thereby causing the more regular flow of the liquids, as the air passes into the bottle by one division, and does not interfere with the outflowing current passing through the other division.

Fig. 5.

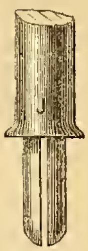
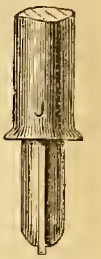


Fig. 6.



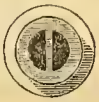


Fig. 7.

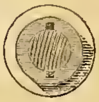


Fig. 8.

UMBRELLA FRAMES.

H. Holland, *Birmingham.—Patent dated September* 22, 1854.

In the ordinary process of preparing the tubular ribs used in the manufacture of certain classes of umbrellas and parasols, the steel tube is indented whilst in a softened condition at the part where it is intended to fix the stretcher joint, without the previous insertion of any substance within the tube. According to the present invention, however, a piece of wire is inserted into the softened tube, at the part where the indentation is to take place. This wire is preferred to be of steel, and thus, on indentation occurring, the substance of the tube is forced down upon the wire, and the part becomes almost solid. Another part of the invention consists in making tubular stretchers for umbrellas and parasols with forks for attachment to the ribs, similar to the forks usually made of solid wire. Instead of inserting a piece of wire, and then flattening the tube and wire together as at present practised, this invention provides for the formation of the fork, by the insertion into the end of the tube to be forked, of a piece of wire an inch long, for example, and then slitting up this piece of wire in the usual way. Both the wire and the tube are slit at once by this process, and the split is afterwards opened and shaped, so that each prong of the resulting fork presents a combination of iron and steel.

Fig. 1.

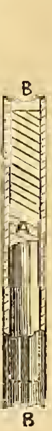


Fig. 2.

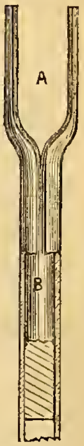


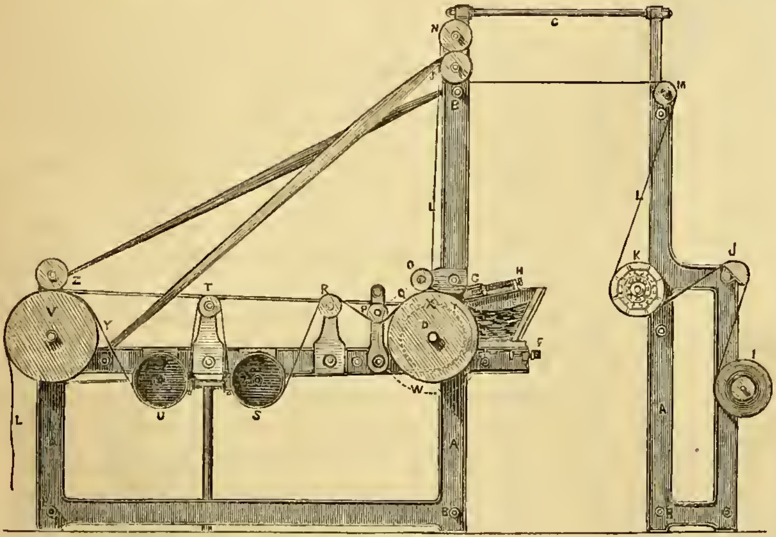
Fig. 1 of our illustrations represents an enlarged section of a portion of an umbrella or parasol rib, showing the position of the strengthening wire therein. A piece of soft steel wire, A, is inserted into the soft steel tube, B, which forms the rib. This wire is inserted before the tube is quite closed at its edges, and is pushed therein by slight pressure with a steel pin, the length of which will regulate the distance to which the wire will be inserted into the tubular rib. This small piece of steel wire thus inserted is fastened or secured in its place by press tools, which are grooved in accordance with the diameter of the ribs. The tube is then indented upon the strengthening piece of steel in the place where the stretcher joint is to be fixed. For this purpose, Mr. Holland prefers the mode patented by him in 1840. But in place of forming the indentation on the outside of the ribs, he forms it on the stretcher side thereof.

Fig. 2 is a section of a tubular stretcher with the fork, A, strengthened according to the present improvement. Before the edges of the tubular stretcher are quite closed, there is inserted at the end intended to be forked, a short-length of charcoal iron or soft steel wire, B, of sufficient thickness to fit tightly therein. The end is then submitted to pressure in press tools, the punch and bed thereof having semicircular grooves formed in them. The end to be formed into a fork is now split in the manner adopted for splitting common iron stretchers, care being taken, however, to keep the joint of the tube uppermost. The iron or steel pin, B, is split to the required length by one blow of the press, and the subsequent processes of making the fork are the same as for stretchers of the ordinary description, except that the end of each prong of the fork is cropped round after it is flattened. This deviation from the ordinary mode is occasioned by each side or prong of the fork being composed of two thicknesses of steel, or one of steel and one of iron. After the stretchers are hardened and tempered, the forks are softened by heating the prongs to a dark-red heat.

STARCHING WOVEN GOODS.

J. Cunningham, *West Arthurlie, Renfrew.—Patent dated Dec.* 18, 1854.

The operation of spreading starch upon textile fabrics, as pursued by the bleacher and finisher, is a very heavy part of the work. Until very recently, the vast areas of piece goods which pass through the finisher's hands, had the starch rubbed into their fibres either by hand, or by the rudest and least efficient substitutes. Now, however, that the attention of parties interested has been directed to the crudeness of the system, various mechanical substitutes have been tried, and amongst these we now come to consider that of Mr. Cunningham.



The principle of this machine is the use of a rapidly revolving starch roller, on which the starch is first supplied from a feed chest, and this roller running at a much greater surface velocity than that of the traverse over it of the fabric, the starch is well rubbed into the very heart of the fibres. Our engraving is a sectional elevation of the machine. It consists of two frames connected together, each frame consisting of a pair of cast-iron side standards, A, connected together by a series of transverse tie rods, B, the connection between the two frames being by the two longitudinal tie rods, C. The starching roller, D, is carried in bearings in the side standards, and in this instance is made to work through the trough, E, containing the starch. This trough is supported at its ends by the side standards, and is open to the roller, D, at one side. It is made capable of adjustment up against the roller by means of screws, F, so that the edges of its ends and bottom may be kept in close contact with the roller surface, and thereby prevent the oozing out of the starch. The roller, D, revolves in the direction of the arrow, and passing through the starch, carries up a film thereof, which film is rendered uniform in thickness, and free from superfluities by means of a doctor, G, placed a little above the surface of the starch, and made capable of adjustment by screws, H, in such a manner as that its edge may be set at any distance from the surface of the roller, according to the thickness to which the film of starch is to be reduced. The fabric to be starched is unwound from a roller, I, and first passes over a pair of breadtheners, J K, in order to render it smooth and free from creases. The breadthener, J, is of the ordinary fixed kind, consisting of a rounded wooden beam, with inclined grooves cut upon its surface, and running in opposite directions on each side of the centre. The breadthener, K, is also of a well-known kind, consisting of a cylinder, composed of staves, divided at their centres, and made to separate lengthways by means of oblique guide discs on a fixed spindle. It may, however, be remarked, that any kind of breadthener may be used. The fabric, L, next passes over a guide roller, M, and thence round and between a pair of nipping rollers, N, passing first below the lower roller, N, then between them both, and finally over the upper roller. It next descends and passes under a pair of guide rollers, O, P, placed in such a position as to make the fabric pass in contact with the starching roller, D, at Q, between them, at which point it receives the starchy application. The fabric afterwards passes over the guide roller, R, under the steam-heated drying can, S, over the guide roller, T, under the second steam-heated drying can, U, and finally over the delivery roller, V. The starching roller, D, is driven by means of a belt, its spindle carrying a pair of pulleys, W, to receive it. The other end of this spindle has fast on it a pulley, X, a belt from which passes to a pulley, Y, fast on the spindle of the delivery roller, V, and so drives this last. The spindle of the roller, V, also carries another pulley, Z, from which a belt passes to a pulley, *a*, on the spindle of one of the nipping rollers, N, and by these means the fabric to be starched is passed through the machine. The several details of the machine may be driven in various ways, but it is essentially necessary, in carrying out the invention, that the starching roller, D, be driven at a considerably faster rate than that of the fabric passing over it, so that the starch may be well rubbed into the pores of the fabric.

PURIFICATION OF TIN.

Dr. A. P. Price, *Margate.—Patent dated June* 22, 1854.

The processes comprehended in this patent refer to the separation of tin from certain metals with which it may be alloyed or mixed, such as gold alone, or gold and either silver, copper, or lead, or such as lead, copper, antimony, arsenic, tungsten, zinc, or iron alone, or any or all of these metals together. A portion of the improvements consists in subjecting impure tin to the action of hydrochloric acid, and in decomposing the solution of chloride of tin so obtained by means of ammoniacal-gas liquor, or other ammoniacal liquor, or with the volatile alkaline ammoniacal products obtained therefrom, or with ammonia or carbonate of ammonia, so as to precipitate the tin existing in solution, and to obtain a valuable product, namely, muriate of ammonia. The oxide and other compounds of tin thus precipitated may, if necessary, be calcined or roasted in a suitable reverberatory or other furnace, and the oxide or oxides thus obtained may subsequently be reduced in a suitable furnace with carbonaceous matter, in order that metallic tin may be obtained therefrom, or the compounds of tin obtained as before mentioned may be otherwise treated. The solution of muriate of ammonia, after separation from the precipitated compounds of tin, may be evaporated, and crystals of muriate of ammonia be obtained, or the same may be obtained by sublimation or otherwise. Should the alloy or mixture have contained lead, then the lead may be separated from solution by the employment of sulphuric acid; the solution of tin thus freed from lead may then be treated with ammonia, or with any of the ammoniacal compounds, as hereinbefore mentioned.

By another process the impure tin is purified by effecting the solution of as much of the tin contained in the alloys or mixtures as is soluble in hydrochloric acid, or is capable of being dissolved by means of a solution of bichloride of tin, and decomposing the solutions thus obtained by means of sulphurous acid, which said sulphurous acid is to be passed into solutions of protochloride of tin either at the ordinary or at an elevated temperature, until the protochloride of tin has been in part or entirely converted into bichloride of tin, and the bisulphide of tin thus formed is to be separated from the solution by decantation or filtration. The decanted or filtered solution of bichloride of tin may then be employed for dissolving the tin contained in impure tin, which it will do, at the same time becoming reduced to the state of protochloride of tin, or the tin may be precipitated from the aforesaid solution containing bichloride of tin, by means of any of the aforesaid ammoniacal compounds. The solution of protochloride of tin, obtained by boiling or digesting a solution containing bichloride of tin obtained as before mentioned, with tin containing any of the impurities mentioned, may be again subjected to the action of sulphurous acid as before mentioned, or may be decomposed by means of any of the ammoniacal compounds, or by means of any of the precipitants, lime, carbonate of lime, or carbonate of magnesia; instead of employing sulphurous acid, sulphite or hyposulphite of ammonia may be employed, and the solution of chloride of ammonium resulting may be subsequently evaporated, and the salt of ammonia be obtained therefrom. The sulphides of tin obtained as before mentioned, may be calcined or roasted in a suitable furnace, and be thereby converted into oxide of tin, which oxide of tin may be treated with carbonaceous matters so as to obtain metallic tin therefrom, or the sulphides may be otherwise treated.

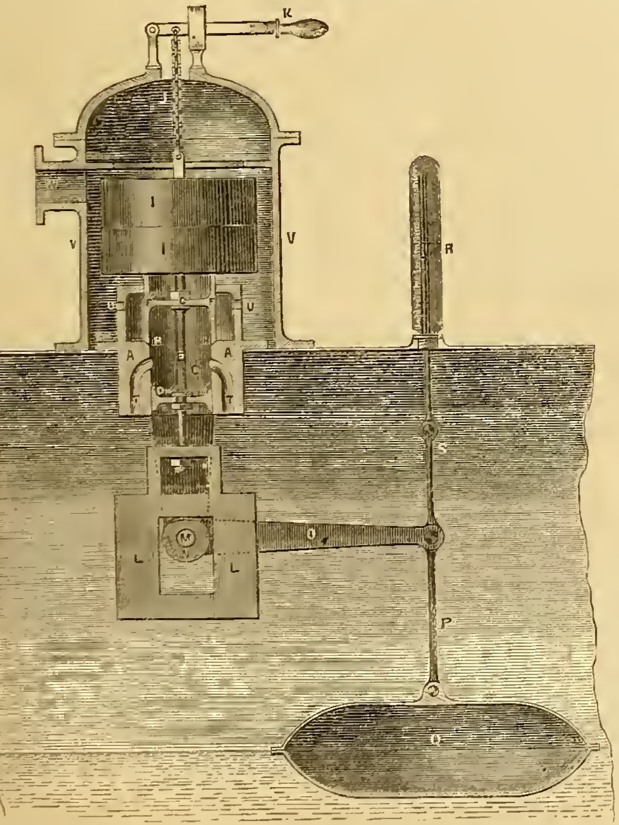
The improvements further consist in using either carbonate of lime or carbonate of magnesia or lime, to precipitate the tin contained in the solution of chloride of tin, obtained by subjecting impure tin, or tin containing or mixed with gold, silver, copper, lead, arsenic, antimony, iron, or tungsten, to the action of hydrochloric acid; and after the separation of the solutions of chloride of calcium or chloride of magnesium from the oxide of tin thus precipitated by decantation or otherwise, reducing the said oxide of tin thus obtained with carbonaceous matter in a suitable furnace, and thus obtaining metallic tin. Any lead existing in solution may be precipitated by means of sulphuric acid, as before described.

The residues resulting from the treatment by any of the foregoing processes of impure tin, which may contain gold or silver either alone or mixed with tin and other impurities, may be treated in the manner described in Dr. Price's former patent.*

SAFETY VALVES.

W. Ashton, *Preston.—Patent dated October* 27, 1854.

We remarked, no later than last month, upon the impossibility of obtaining a clear thoroughfare with the common escape valve of steam boilers. We now present an additional contrivance for securing this desirable end. This is the invention of Mr. Ashton, a mechanical engineer of Preston, whose arrangement we represent in vertical section, as fitted upon a steam boiler. In our engraving, A is a cast-iron cylinder bolted on to the top of the boiler, and within the central opening, C, of this cylinder, which is accurately bored, works the metallic disc or guide, D, which is secured to the valve spindle, E. Higher up on this spindle is similarly secured a tube, F, which is closed by the diaphragm, O. The lower edge or lip of this tube is bevelled slightly, and fits accurately into the valve seating, H, in the cylinder. The spindle, E, is carried up some distance through the tube, F, for the purpose of receiving one or more weights, I, which rest upon the upper edge of the tube. A chain, J, is attached to the end of the valve spindle, and is connected with an overhead lever handle, K, for the purpose of blowing off when requisite, or for working the valve occasionally to prevent it from sticking. To the lower extremity of the valve spindle is attached another weight, L, having an opening in its centre, through which opening is passed a transverse locking shaft or spindle, M, working in and supported by brackets attached either to the boiler itself, or to the lower portion of the cylinder, A. A cam or eccentric, N, is keyed on to the shaft, M, and is placed inside the opening in the weight, L. O is a lever arm, which is keyed on to the shaft, M, and is connected by a rod, P, at its free end with the hollow float, Q, which rests upon the surface of the water in the boiler. This float is composed of wrought-iron welded all round the edges, so as to be perfectly steam and water tight. The true level of the water in the boiler may be indicated on a graduated plate, R, fitted on to the top of the boiler, the index being connected by a rod or link, S, with the free end of the lever, O. The steam pressure is exerted against both sides of the guide, D, and against the under side of the diaphragm, O, since the steam is allowed to enter between the guide and the diaphragm by four lateral steam ports, only two of which, T, are cast in the sides of the cylinder. When the valve opens, the lower lip of the tube, F, will be raised off its seating, H, and the steam will escape all round the tube, and out by the lateral openings, U, in the cylinder, passing thence into the dome, V, and out by the blow-off pipe, W. The upward pressure against the diaphragm, C, will be equal to the downward pressure on the guide, D, until the pressure under the guide, D, causes the valve to open, whereupon the steam pressure inside the valve or tube, F, will decrease, and the force of the steam upwards will assist in raising the valve. The valve will also be opened by the action of the float, Q, should the level of the water in the boiler be either unnecessarily high or dangerously low, in which cases the lever arm, O, will be either raised or depressed accordingly, and the cam or eccentric on the shaft, M, will, by turning either in one direction or the other, elevate the valve spindle, E, and open the valve. The level of the water in the boiler will be constantly indicated by the indicator at R, so that a double source of safety is obtained by this arrangement, whilst the safety valve itself is internally weighted, and, consequently, entirely out of the control of the engineer.



REVIEWS OF NEW BOOKS.

The Iron Manufacture of Great Britain, Theoretically and Practically considered. By William Truran, C.E. 4to plates, pp. 176. London: E. & F. N. Spon. 1855.

The gigantic part which the iron manufacture of Great Britain has played and is playing, in forming and fostering her national greatness, may well cause us to indulge in thoughtful contemplation upon a history like the one before us. When we remember that South Wales, South Staffordshire, and Scotland collectively, produce far more of this most precious of metals than all the world beside, we shall begin to form some realisation of what the rest of the earth owes to these localities. Still more vividly does this come before us with the fact that, whilst British industry works out one half of our raw product, we still export nearly as much as the combined amount for which the world is indebted to other nations. Our production of crude pig iron during the past year exceeded three and a half millions of tons. Of wrought iron, we made two millions of tons in the same time. The value of this converted mineral, at the prices of the time, stands at £25,000,000. To get through all the work of mining, smelting, and manufacturing involved in this great trade, the services of 238,000 operatives are required, having more or less under their care 2120 steam engines, developing 242,000 horses' power.

Mr. William Truran, "formerly engineer at the Dowlais Iron Works, under the late Sir John Guest, Bart., and subsequently at the Hirwain & Forest Works, under Mr. Crawthey," has signalised himself by being the first man to give us anything like a history of all this. In twenty clear and practically well-written chapters, backed by twenty-three elaborate plates of mining, smelting, and manufacturing apparatus, he has told us all that can be told up to the present day, in a style at once pleasing to the general reader and the scientific industrialist. The book is doubly welcome just now, when we are labouring under difficulties—particularly in the Scottish iron districts—as regards the supply of raw material. Year by year the cost of ore seems to advance; and, as old fields become exhausted, new ones, hitherto disregarded, either because they are remotely situated, or because their product is ungratefully poor, are sought out and drawn upon in satisfaction of the cravings of the ever-gaping smelting furnaces. Such an aspect of affairs in the greatest iron producing country in the world is grave enough, and we, therefore, cannot pay too much attention to men like Mr. Truran, who bring us the aid of a long practical experience in their art, towards the determination of new sources of material, new systems of treatment, and new roads to economy. Let us see what our author says on the—

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*At page 60, Vol. VIII., Practical Mechanic's Journal.

“Theory of Production.

“The foundry-iron furnace at the Dowlais works is of 275 cubic yards capacity, and is blown with a blast of 5390 cubic feet of air per minute. The materials charged at the top consist of calcined argillaceous ore, coal, and limestone. The yield, or consumption, averages 48 cwts. of calcined ore, 50 cwts. of coal, and 17 cwts. of broken limestone, to 20 cwts. of crude iron obtained. The weekly make of iron is occasionally over 130 tons; but we may assume this as sufficiently high for our calculations. The produce of cinder weekly, amounts to nearly 250 tons.

“The weekly consumption of solid materials at top will be as follows:—calcined ore, 312 tons; coal, 325 tons; limestone, 110 tons 10 cwts,—total, 747 tons 10 cwts. By measurement these materials in a mass would occupy 1066 cubic yards. The air delivered by the tuyeres weekly, weighs 1695 tons, and measures 50,550,000 cubic feet, or 1,872,200 cubic yards. With these quantities we deduce the following ratios, as being the extreme proportions when the iron is of a grey quality.—Nos. 1 and 2, smelted from argillaceous ores with raw coal as fuel. The weekly consumption of solid materials is at the rate of 54 cwts. per yard capacity. The weekly produce of liquid matter from the hearth is nearly 28 cwts. per yard capacity of furnace. The produce of metal from the hearth is at the rate of 9½ cwts. weekly, for each yard capacity of furnace. Each ton of coal charged into the furnace suffices for the production of 23·4 cwts. of liquid matter in the hearth. Estimated on the carbon in the coal, the ton of iron is produced with a consumption of 43·5 cwts. of carbon; and the ton of liquid matter, iron, and cinder, deposited in the hearth, with a consumption of 17·1 cwts. of carbon.

“The solid materials introduced into the furnace weekly, measured in their original form 1166 cubic yards; the liquid matter obtained, measures 172 cubic yards. The solid materials charged at the top, are in the furnace 40 hours before reduced to the liquid form. The solid materials descend through the throat at the rate of 28 inches per hour; at the top of the boshes the velocity of descent is reduced to 7 inches per hour; but is accelerated at the hearth to 35 inches. The consumption of blast per minute is at the rate of 20 cubic feet of air to each yard capacity of furnace. The ton of crude iron is produced with a consumption of 388,850 cubic feet of air. The air decomposed in the process of smelting one ton of iron weighs 13 tons. The weight of the air introduced through the tuyere is to the weight of the solid materials introduced at top, as 16 is to 7. The materials, solid and gaseous, charged into the furnace, for each ton of iron smelted weighs 18·8 tons. The weekly consumption of solid and gaseous materials weighs 2442 tons, of which 380 tons are obtained in a liquid form from the hearth; the remaining 2062 tons escape in the gaseous form at the tunnel head. Hence, for each ton of liquid matter obtained, 129 cwts. of gases are evolved from the furnace. The atmospheric air introduced weekly, measures 1,872,200 cubic yards; the gases evolved from the tunnel head measure 7,488,000 cubic yards. The ascending gases traverse the furnace at its largest diameter at the rate of 415 feet per minute, increased at the throat to 1,660 feet. The time which elapses from the admission of the atmospheric air at the tuyere, to its escape at the tunnel head in combination with the gaseous products of combustion, is nearly 7 seconds.

“For the production of white iron for the forge, in furnaces of the same capacity as the foregoing, a larger volume of blast is employed along with a different burden of materials. The blast averages 7,370 cubic feet per minute. The consumption of materials to a ton of crude iron averages 28 cwts. of calcined argillaceous ore, 10 cwts. of hematite, 10 cwts. of forge and finery cinders, 42 cwts. of coal, and 14 cwts. of limestone. With these materials, the weekly produce amounts to 170 tons of crude iron, and 310 tons of cinder. The consumption of solid materials is 884 tons, measuring 1,103 cubic yards, and of air 2,318 tons, measuring 68,983,000 cubic feet. Hence, the total weekly consumption amounts to 3,202 tons, which is resolved during the smelting process into 480 tons of liquid, and 2,722 tons of gaseous matter. Under these circumstances, the consumption of solid materials is increased to 64 cwts. per yard capacity, but the volume is not sensibly greater, consequently they are in the furnace nearly the same time as for grey iron. And the liquid and gaseous products bear to each other nearly the same relation as in the production of grey iron. But the ton of crude iron is produced with 36·5 cwts. of carbon, and the ton of liquid matter with 13 cwts. of carbon.

“In consequence of the larger volume of blast, and comparatively dense manner in which the materials lie in the furnace, the gaseous column escapes with the high velocity of 2,900 feet per minute; hence, the time occupied by the ascending gases in traversing the height of the furnace is reduced to 4 seconds.

“For the production of a more inferior iron for the forge, the burden is composed of the following materials;—hematite ore, 16 cwts., refinery cinders 25 cwts., coal 36 cwts. and limestone 16 cwts. to the ton of crude iron. Capacity of furnace, and volume of blast, the same as in the last instance. A weekly produce of 190 tons has been attained, accompanied with the production of 295 tons of cinder. The weekly consumption of solid materials amounts to 883 tons, measuring 934 yards, of air 2,318 tons,—total 3,201 tons. This is resolved into 485 tons of liquid, and 2,716 of gaseous matter.

“In the production of this cinder iron, then, the consumption of solid materials is at the rate of 64 cwts. per yard capacity; but from their greater density, the time which they are in the furnace prior to fusion is increased to 46 hours. The ton of iron is produced with a consumption of 31·3 cwts. of carbon, and the ton of liquid matter with 12 cwts. The materials used being of a greater density, the ascending column of gases traverse the heights of the furnace in 3·5 seconds.

“The Hirwain foundry-iron furnace measures nearly 200 cubic yards, and is blown with 2,541 cubic feet of air per minute. Yield of materials,—calcined ore 46 cwts., coke 34 cwts., limestone 16 cwts., to a ton of crude iron. Produce, 90 tons of crude iron, and 150 tons of cinder, weekly. Hence the weight of solid materials introduced weekly is 432 tons, measuring 730 cubic yards; and air 800 tons, measuring 23,783,000 cubic feet. Consumption of solid materials per yard capacity of furnace, 43 cwts. Produce of crude iron per yard capacity, 9 cwts; of liquid matter 24 cwts. The ton of iron is produced with a consumption of 32 cwts. of carbon, and the ton of liquid matter with 12 cwts. The solid materials comprising the descending column are in the furnace nearly 43 hours. In consequence of the diminished volume of air, and the porosity of the coke, the ascending gaseous column is 12 seconds in traversing the height of the furnace.

“By employing a larger volume of blast, the produce of iron from the Dowlais and Hirwain foundry-iron furnaces may be largely augmented, but with the proportion of carbon given, the resulting iron is of a white quality. With a larger volume of carbon, however, the grey quality may be maintained with the augmented produce. By employing a lesser volume of blast, accompanied by a diminished produce, a reduced volume of carbon suffices for the production of grey iron.

“The larger consumption of carbon to produce grey iron, with a volume of blast exceeding 20 feet per minute per yard capacity of furnace, is partly due to the more rapid descent of the materials, permitting of a lesser quantity of gaseous carbon combining with the metal. The chief cause, however, we consider to be the accelerated velocity with which the ascending column of gases pass through the furnace. In the Dowlais furnace the ascent occupies 7 seconds, in the Hirwain furnace 13 seconds. Hence, in the latter, the vapour of carbon in the ascending column is in contact with the materials nearly twice the length of time. It is principally to this circumstance that we ascribe the lower yield of carbon to the ton of liquid matter produced from the Hirwain furnace. Probably the degree of carbonization is dependant more on the velocity of ascent of the gaseous carbon than on the quantity of solid carbon charged at top. On no other supposition con we account for the superior reducing power of a given weight of carbon in the Hirwain furnace.

“The consumption of carbon to produce one ton of crude iron, and to produce one ton of liquid matter is almost identical at the Dowlais cinder-iron furnace, and the Hirwain foundry-iron furnace; but in the former, notwithstanding the materials are in the furnace 3 hours longer, the quality of the iron is an inferior white, while that of the latter was fair ordinary grey. But in the velocities with which the gases pass through the furnace there is a wide difference. The heated gases escape from the Dowlais furnace with a velocity of 2,900 feet per minute, and traverse the furnace in 3·5 seconds; in the Hirwain furnace the escape is at the reduced rate of 788 feet per minute, and the time of traversing the height of the furnace increased to 12 seconds.

“If the degree of carbonization were dependant on the quantity of vapour of carbon brought in contact with the ore, the Hirwain furnace possesses no superiority over the Dowlais, the like quantity of gaseous carbon being evolved for each ton of crude iron. But if time is an element, which in connection with the gaseous column affects the degree of carbonization, the immense difference in quality is immediately explained. When the important part played by the gaseous matter in the reduction of the ore is considered, the probability that the velocity of ascent has a greater influence on the quality than the quantity of solid carbon charged at top, is greatly strengthened. In the Dowlais furnaces the vapour of carbon ascends at the rate of nearly 50 feet per second; it is while in this rapid motion that the gaseous carbon has to effect the deoxydation of the ore, and carbonization of the metal. The perfect combination of the oxygen of the ore with the gaseous carbon being the work of time, the great velocity of the gases in the Dowlais furnace cannot be so favourable to the combination as the reduced velocity of the Hirwain furnace; hence, the deterioration in quality.

“It is probable, however, that the nature of the ore has an important connection with the degree of carbonization in certain cases, though not in the one described. With the dense hematites, and silicious ores, the gases volatile in the upper regions are of inconsiderable amount, and the original dense structure of the ore is nearly unchanged. The deoxydizing influence of the gaseous carbon consequently is limited to the surface of the pieces; and of the oxygen in the original volume of ore, a large portion is liberated at the zone of fusion. Hence, an inferior white iron, containing a minimum dose of carbon, is produced.

“The argillaceous and carbonaceous ores—the carbonates of the coal formations, are a totally different structure in the furnace. The operation of calcination expels the carbonic acid, and leaves the wasted ore of a porous structure, permeable to the gaseous carbon and augmenting the surface of metal exposed to the deoxydizing influence of the ascending column. With the carbonaceous ores the combustion of the carbonaceous matter, coupled with the expulsion of the carbonic acid, results in the ores of this class being highly susceptible of deoxydation. All other conditions being similar, the carbonization of the metal will be in nearly the same ratio as the porosity of the ore.

“By employing a larger blast, the produce may be largely increased at the expense of quality. With a suitable blast the weekly produce of inferior white iron may be doubled, and a make of 300 tons be readily attained. With this large produce, however, the manufacture is not so economical as with lesser quantities.

“The produce of furnaces smelting carbonaceous ores is not subject to the same limits, as to quality, as furnaces on other ores. From the large quantity of carbonaceous matter in combination, the richness of the ore in metallic iron, and its porous structure, a larger quantity of metal of a given quality may be produced from the same capacity of furnace. The volume of blast is much smaller, and the produce of cinder scarcely exceeds in weight that of the crude iron.

“The furnaces at the Dundyvan works, Scotland, average 167 cubic yards capacity, blast 3,040 cubic feet per minute. Yield of materials—calcined carbonaceous ore 33 cwts., coal 40 cwts., and limestone 5 cwts. to the ton of crude iron. On these materials the furnaces average 150 tons of iron, and 140 tons of cinders weekly. The consumption of solid materials is 584 tons 10 cwts., measuring 785 cubic yards. The blast weighs 950 tons, and measures 28,454,000 cubic feet. Hence, the consumption of materials amounts to 1,434 tons, which is resolved into 290 liquid and 1144 tons of gaseous matter. A ton of the former is accompanied with 78 cwts. of the latter, against 129 cwts. with the argillaceous ore. The weekly consumption of solid materials is at the rate of 70 cwts. per yard capacity of furnace. The weekly produce of liquid matter from the hearth is 34 cwts., and the crude iron 18 cwts. per yard capacity of furnace. Each ton of coal charged into the furnace suffices for the production of 21 cwts. of liquid matter. Estimated in the carbon, the ton of iron is produced with a consumption of 30·4 cwts., and the ton of liquid matter with 15·6 cwts. The solid materials forming the descending column are in the furnace 33 hours prior to fusion. The consumption of blast per minute is at the rate of 18 cubic feet per yard capacity of furnace. The air decomposed in the process of smelting one ton of crude iron weighs 6·3 tons. The gases escape through the throat with a velocity of 1,500 feet per minute. The gaseous column is 7·5 seconds in ascending from the tuyeres to the throat.

“Iron smelted from carbonaceous ores with the fuel and blast described, contains a larger per-centage of carbon than is found in Welsh irons smelted from argillaceous ores, as will be seen by referring to the analysis of crude irons. The principal defect of the Scotch pig iron is seen in this large per-centage of carbon, rendering it excessively fluid, and incapable of being readily converted into malleable iron. On reviewing the quantities of liquid matter obtained from the hearth, for a given weight of carbon consumed, the Scotch furnaces are placed in a most anomalous position. Smelting the most fusible ore extant, 15·6 cwts. of carbon are consumed for each ton of liquid matter produced. At the Hirwain foundry-iron furnace, smelting a less fusible ore, the consumption is only 12 cwts. It is this excess of carbon to liquid matter, coupled with the comparatively slow ascent of the gaseous column, and the very fusible character of the ore, which lowers the quality and strength of the crude iron.

“For the production of this metal from carbonaceous ores, for conversion into malleable bars of a superior quality, with a minimum waste in the refining and puddling processes, the proportion of carbon to liquid matter must be reduced more than one half, and the velocity of the ascending gaseous column accelerated to twice its present rate of ascent. The resulting metal will then contain a low per-centage of carbon, and may be readily converted into malleable bars.”

This is an interesting chapter; the more so when we bear in mind the ascertained losses of material to which iron-masters are compelled to submit in their processes of conversion. A great proportion of forge iron furnaces are worked with a dead loss of 20 per cent. of metallic iron in the burden of materials; and the cinders average a content of some 11 per cent. of iron. In some highly-burdened furnaces the cinders actually show from 13 to 16 per cent. of iron. South Wales alone is computed to lose irrecoverably about 250,000 tons of iron in this way; whilst, if we widen our calculating ground to the whole of Great Britain, we are driven to the conclusion that 700,000 tons of iron are annually sacrificed in this way. It is in discussing this section of his subject that we have to find fault with the author for uselessly perpetuating a grossly inaccurate expression as to the "yield of materials."

> "The quantity of ore or other material consumed in the manufacture of one ton of iron is known amongst smelters as the "yield" of that material. When the consumption is small for the quantity of metal produced, the yield is considered good; when large, the yields are pronounced bad. This term, though strictly speaking incorrect, is applied to nearly all the operations connected with an iron work."

Can it be believed that, in the nomenclature of the iron-maker, the "yield" is precisely what is not yielded?

In speaking of the hot blast, Mr. Truran very properly enters upon a fair apportionment of the real merit and productive advantage due to the system, and he mercilessly cuts down the gain on this head to what must be confessed is a practical shape. Farther than this, he resolutely combats the modern theories as to the utilization of the waste gases of the blast furnace, about which so much has been said and so surprisingly little done during the last few years. Mr. Truran sums up his views of the question thus:—

> "After a careful examination of the various modes of collecting adopted in this country and on the continent, and having witnessed the alterations produced on the operations of the blast furnace by each, we are of opinion that it is neither expedient nor profitable to control the escape of the gases; and farther, we are of opinion that, where the consumption of coal is proportioned to the requirements of the case, not one atom of gas, nor one unit of heat can be withdrawn from a furnace, without disturbing the equilibrium of the smelting. This opinion is at variance with the statements of continental chemists, but it must be remembered, that their estimates of the commercial value of the products of combustion, have invariably been drawn from theoretical calculations, founded on experiments in chemistry, and are based on the assumption that they may be withdrawn in quantity without affecting the smelting; the fact of their withdrawal occasioning an alteration in the economy of the furnace, has been established in practice. By other calculations, founded on equally unsafe data, the heat capable of being attained by their combustion under ordinary circumstances was greatly overstated; in practice, the maximum working temperature scarcely reaches a third of the theoretical estimate. Altogether the brilliant anticipations formed of the value of these gases for heating purposes have not been realised, and the policy of withdrawing them for such purposes may fairly be questioned."

We confess to having held favourable opinions on the withdrawal of the gases, but we are now obliged to admit that we cannot attempt to say nay to Mr. Truran's settled views and convictions.

Our blowing engines Mr. Truran very properly condemns as being far behind the requirements of the time, and as presenting no earnest of our engineering successes in other departments of mechanical construction. This ought not to be. We have about 310 such engines at work in this country; and, where there is so large a field for display, we ought to have something more to show than the generally miserable specimens of the time. Mr. Truran might have done some good here, by giving one or two plates of really good modern blowing engines, or designs for obviating the many evils which he so unhesitatingly condemns in his short unillustrated chapter on this subject. Mr. Neilson's "portable blowing engine," given in our own plate 153, vol. 7, shows that there is a spirit astir for improvement even here.

The conversion of cast into malleable iron is well illustrated in the volume. So also is the rolling process for the production of bars of all kinds; but in all this there is a shade too much of old school practice. As regards squeezers, nothing is said of those of rotatory action, the examples being confined to two crank and lever arrangements of but crude construction. Neither have we any steam hammers, without which we cannot but regard the book as somewhat incomplete.

Cyclopædia of Chemistry, with its Applications to Mineralogy, Physiology, and the Arts. By R. D. Thomson, M.D. With numerous illustrations. London and Glasgow: Griffin & Co. 1854.

We have taken some pains to examine this work, and can strongly recommend it as a compendium handbook of applied chemistry. It is not the mere compilation of a sciolist, but the production of an accomplished chemist, who holds a professorship of the science in one of the London hospital colleges. Such books as this, Balfour's Botany, and Phillips' Geology, issued by the same publishers, are infinitely cheaper than the lower priced volumes, for the most part ill-edited translations, forming Bohn's Scientific Library. The information in these books can be relied on; they are written by competent men of sound views, and the language is clear and concise. The book before us is, however, susceptible of improvement. The author has not always kept in mind that it was not intended to furnish a cyclopædia of universal science, but, if we may judge by the title, a cyclopædia of chemistry. Consequently, such articles as *Geology*, *Crystallography*, *Dew Point*, *Goniometer*, are altogether out of place. So are the purely mineralogical articles, such as *Made Peastone* and *Cross-stone*, when analyses are not given, as well as the purely geological articles, such as *Fault* and *Dike*. Again, historical statements, such as we find under *Acetic Acid* and *Atomic Theory*, had better have been omitted; and we could have spared the very frequent references to relations and pupils which Dr. Thomson indulges in. On the other hand, such articles as *Dyeing*, *Caoutchouc*, *Photography*, and *Metallurgy* ought to have received further development. Under *Caoutchouc* nothing is said as to the hard compound of sulphur and india-rubber, which is now coming into very extensive use. To *Photography* and *Metallurgy* only two lines are given; the reason being, we presume, because the publishers have issued separate treatises on these subjects. But this consideration ought not to have influenced Dr. Thomson. The illustrations, though numerous, are bad and coarse. We notice a few misstatements here and there, with a correction of which we shall terminate our notice. *Cochineal.*—The colouring matter is certainly not derived from the plant on which the insect feeds, in the sense, at least, intended by Dr. Thomson when he makes the assertion. In most of the *opuntias* from which the insect obtains its sustenance, the flower is yellow, and not scarlet; and the juice of the leaf or stem is pale green, or colourless, like water. *Semolina.*—The semolina of the shops is the seed of a grass termed by botanists *Poa fluitans*, and is not the broken grain of wheat. Semola, a substance not noticed in the Cyclopædia, is the *gluten* of wheat, and hence, probably, arose the mistake. Under *Arrow Root* it should have been stated that a large quantity of the starch imported under that name is obtained from the tubes of various species of *curcuma*. Under *Epiphyte* there is some confusion of expression. We are told that epiphytes are plants which grow on the stems of others, then those stems are termed soil, and afterwards the language implies that epiphytes may grow in the earth.

On the Uses and Application of Cavalry in War. By North Ludlow Beamish, Lieut.-Colonel. 8vo, pp. 456. London: T. & W. Boone. 1855.

Colonel Beamish comes before us with a literary standing going back to 1827, when he published a translation of Count Von Bismark's "Lectures on the Tactics of Cavalry," and his present performance consists of this work, amended and remodelled, to carry us through the nearly thirty years which have elapsed since British readers were first made aware of the Würtemberg experiences. The present volume naturally contains many suggestions for change in our cavalry system; and these changes are judiciously summed up under eleven clear heads in the preface, so that the reader knows at once with what he has to deal, without the trouble of reading through the whole of the pages. Briefly specified, these proposed changes are, the assimilation of all cavalry into light cavalry only; the use of the lance as the weapon in chief, with belt revolvers, and a fifth division carrying breech-loading needle rifles, firing cylindro-conoidal shot, on the principle of the Zündnadelgewehr; the restriction of the soldier to 5 feet 8 inches height, and 10 stone weight, with horses of but 15 hands; the discontinuing the present superfluous clothing; the provision of the means of spiking and carrying off guns; movements by divisions instead of by threes, and rank entire instead of two deep; bridle bits of severity to suit the actual horses of the regiment; annual encampments and field drill; the establishment of a cavalry college; the prohibition of interchanges betweeen cavalry and infantry; and that a first-class certificate from the senior department of the R. M. College at Sandhurst be an indispensable qualification for staff appointments. When we have summed up these points, we have, perhaps, said all that can properly be said on such subjects in the *Practical Mechanic's Journal*.

Colonel Beamish discusses Captain Norton's gunnery inventions at considerable length, and with an able pen, and it is satisfactory to us, who have frequently afforded space for an examination into the merits of these ingenious contrivances, to find them in such good hands.

Dr. Kufahl's needle-gun here also finds a corner, so that in modern mechanical contrivances for the soldier, the author amply redeems his promise of writing for the best practice of the day.

Popular Lectures on Drawing and Design. By William Minifie, Baltimore. 1855. Pp. 58.

These lectures were delivered with the laudable intention of stimulating the American public to a more general practice of the art of drawing than is at present the case. The lecturer urged upon his audiences the desirableness of making the study of drawing a part of ordinary education. He adduced instances to show that a knowledge of drawing is of use in every department of life. He looked, also, at the subject from a national, as well as from an individual point of view; showing the immense value to the community of having able and industrious artists and designers. We agree with the lecturer in every respect, and think that his little *brochure* deserves the attention of the American people.

CORRESPONDENCE.

STEAM BOILER EXPLOSIONS.

The frequency of steam-boiler explosions of late keeps the public alive to the necessity of more satisfactorily ascertaining their causes, and as no suggestions are without value in an inquiry having that object, the following remarks may be worthy of a place in the *Practical Mechanic's Journal.*

Some boiler explosions occur which cannot be laid to the account of mismanagement, weakness of the boiler, defective safety valve, or similar causes, and are therefore open to theoretical and speculative explanations. By some the explosion is thought to arise from the union of opposite electricities. Some consider it to be caused by the sudden formation of large quantities of steam; but this cannot take place by a flue or tube becoming red hot; for when the water is turned on, it rises again gradually, and is a work of some five or fifteen minutes. But to cause an explosion it must take place instantly, without warning of any kind. There is no violent hissing at the safety valve for a few seconds; but the boiler is rent with a suddenly accumulated pressure. According to another supposition, the steam, on being formed, adheres to the bottom of the boiler, and prevents the contact of the water, until some disturbance precipitates the latter on the hot plates. But even in this case, I believe the safety valve would show the rapid increase of pressure during several seconds; because the boiler should not give way till the pressure has been raised to two or three times the working pressure. It is also very questionable whether the ordinary amount of heating surface in a boiler, cooled from 700° to 212°, would raise the pressure from 80 to 160 lbs. I have been led to consider the explosion as arising from a somewhat different cause. Knowing that water is composed of two gases which form a very explosive mixture, I think it is possible that surcharged steam may be so dried and freed from watery particles as to partake more of the nature of gas. Should this be the case with the addition of a red-hot tube, or a spark of electricity, we have the elements of a great explosion. The ignition would not be at all difficult to account for, as the accident frequently occurs when the engine-man is turning on steam, whistling, or meddling with the boiler in some way. In appearance also, surcharged steam, on issuing to the air, is quite free from vapour. The experiment of trying whether steam, under different degrees of heat, could be exploded by ignition, would not be a difficult or dangerous one, and might lead to important results.

Leeds, September, 1855. EDWARD BROWN.

NEW FORMULA FOR CAST-IRON BEAMS.

Mr. Fairbairn, in his recent work on "Cast and Wrought Iron for Building Purposes," states, that for bridges and warehouses, cast-iron beams should not be loaded with more than one-fifth or one-sixth of the breaking weight. I send you a simple formula of my own, which will give the safe load in cwts., equally distributed, at one-fifth the breaking weight. It is derived from Mr. Hodgkinson's formula $W = \frac{26\,a d,}{l}$ where

$W =$ breaking weight in tons in the middle.
$a =$ area of bottom flange in inches.
$d =$ depth of beam in inches.
$l =$ length between supports in inches.

The new formula is $S = \frac{52\ a\ d,}{3\,L}$. where

$S =$ safe load in cwts. equally distributed.
$a\ d$ are the same as above, and $L =$ length between the supports in *feet.*

Bradford, September, 1855 ROBERT H. SKAIFE.

CASTOR OIL AS A MECHANICAL LUBRICANT.

In these times, when workshop economics are claiming so large a share of attention, it may be of importance to the readers of the *Practical Mechanic's Journal* to know that there is considerable advantage and economy in the use of pure castor oil as a lubricating material for machinery. For this purpose, I have found it to go at least twice as far as any other oil. The causes of this gain are, that this oil does not run out of the bearing, whilst it does not clog from viscidity, and it is entirely free from acidity of every kind. Actual experience has told me, that bearings which formerly required oiling twice or thrice a day, are kept in perfect order by one daily application of fine castor oil. As to cost, the present market price leaves, under the circumstances, a saving of 50 per cent.

Glasgow, September, 1855. ALEXANDER CHAPLIN.

THE MEETING OF THE BRITISH ASSOCIATION AT GLASGOW

Fifteen years have elapsed since the last meeting of the Association at Glasgow, and we have now to report a very successful one under the presidency of the Duke of Argyll, which commenced its proceedings on the 12th ult. After the report of the Council had been read, and the accounts gone through, an evening meeting was held, at which the President delivered his address. He alluded, in the first place, to Glasgow, to Watt, to the University. In feeling terms he spoke of the loss of Edward Forbes: and then, with reference to the progress which science has made since the former meeting at Glasgow, he said:—In astronomy, if there had been nothing else to mark the progress of discovery, the construction and application of Lord Rosse's Great Reflector would have been enough to constitute an important epoch. Its systematic operations may be said to be still only in the first stages of their progress; yet already how often do we see reference had to the mysterious revelations it has made in discussions on the principles of that science, and in not a few of the speculations to which they are giving birth! Sir D. Brewster, in his recent Life of Newton, has designated that telescope as "one of the most wonderful combinations of art and science which the world has yet seen." All who are interested in the devotion of abilities, of means and of leisure to the noblest pursuits, must earnestly wish to see Lord Rosse rewarded by that which he will value most, the steady progress of discovery. It must always be remembered, however, that astronomy is a science of which hitherto at least it might almost be said that one great genius had left us no more worlds to conquer; that is to say, he carried our knowledge at a bound to one grand and apparently universal law, to which all worlds were subject, and of which every new discovery had been but an additional illustration. The reign of that law, whether universal or not, was at least so wide, that we had never pierced beyond the boundary of its vast domain. For the first time since the days of Newton a suspicion has arisen in the minds of astronomers that we have passed into the reign of other laws, and that the nebular phenomena revealed to us by Lord Rosse's telescope must be governed by forces different from those of which we have any knowledge. Whether this opinion be or be not well founded—whether it be or be not probable that our limited command over time and space can ever yield to our research any other law of interest or importance comparable with that which has already been determined—still, inside that vast horizon there are fillings-in and fillings-up which will ever furnish infinite reward to labour. Of these not a few have been secured since our last meeting here. Besides the patient work of our professed astronomers, and the good service rendered by such men as Mr. Lassell and Mr. Nasmyth, who have so well relieved the business of commercial industry by their devotion to the pursuits of science, we have had one event so remarkable, that in the whole history of astronomy it stands alone. If, in looking at the wonderful objects revealed to us in Lord Rosse's telescope, we turn instinctively sometimes from the thing shown to the thing which shows—from the Spiral Nebulæ to the knowledge and resources which have collected their feeble light, and brought their mysterious forms under the cognizance of the human eye, —how much more curiously do we turn from the single planet Neptune, to that other instrument which has *felt*, as it were, and found its obscure and distant orbit! So long as our species remains, that body will be associated with one of the most glorious proofs ever given of the reach of the human intellect;—of the sweep and certainty of that noble science which now honours with enduring memory the twin names of Adams and Leverrier.

In geology, the youngest but not the least vigorous of the sciences, every year has been adding to the breadth of its foundation—to the depth and meaning of its results. Probably no science has ever advanced with more rapid steps. In 1840 the then recent publication of the "Silurian System" had just established those landmarks of the Palæozoic world which all subsequent discovery has only tended to confirm. The great horizons which were first defined by the labours of Murchison and Sedgwick have since disclosed the same phenomena which they so accurately described, in every quarter of the globe; and the generalizations founded thereupon have been definitely established. The same period has sufficed, partly by the labours of the same distinguished men, to clear up the relative position of the strata which represent the closing epochs of ancient life, and those which form the base of the secondary age. But, above all, the last few years have seen immense progress made in our knowledge of that vast series of deposits which usher in the dawn of existing forms, and carry us on to those changes which, though the most recent, are not the least obscure of any which have affected the surface of the globe. The investigations of Edward Forbes on the laws which determine the conditions of marine zoology, have supplied us with data altogether new on some of the highest conclusions of the science; whilst his profound speculations on the centres of creation and areas of distribution, have pointed out paths of inquiry which are of themselves of inexhaustible interest, and hold out the promise of great results. Another branch of investigation, which, if not entirely new, is at least pursued on a new system, and with new resources, has been opened up in dynamical geology by the learning and ingenuity of Mr. Hopkins; whilst the thorough elucidation of the conditions of glacier motion, which we owe to Professor James Forbes of Edinburgh, has given us clear and definite ideas in one, and that not the least important of the agents in geological change. The observations accumulated during the recent Arctic voyages have materially added to our knowledge of the operation of the same agency under different conditions—conditions which we know must once have extended widely over the firths and estuaries near where we are now assembled—leaving behind them those enduring records of the glacial epoch which were first explored by my friend, Mr. Smith of Jordanhill. We owe many important observations on the same phenomena, and on the various changes of sea-level, to Mr. Robert Chambers. And if the thanks of science are due to those who advance her interests, both directly by adding to her store of facts or of her discovered laws, and also indirectly by investing them with popular interest, and thus enlarging the circle of observers, we must mention with special gratitude the classical works of Mr. Hugh Miller; and those writings of Sir Charles Lyell, which his indefatigable industry is ever bringing up abreast with the progress of discovery—a progress stimulated in no small degree by his own exertions,—and which are alike remarkable for completeness of knowledge, for fertility of suggestion, and for sound philosophical reasoning. I think we cannot mistake the general tendency of geological research, whether stratigraphical or zoological. It has been to prolong periods which had been considered short; to divide others which were classed together; to fill up spaces which were imagined blank, and to connect more and more in one unbroken chain the course of physical change and the progress of organic life.

We pass from geology by a natural transition to another science which stands to it in close alliance. If all our most sure conclusions respecting the superficial covering of the globe have been founded on the classification of its animal remains, it is not less true that our knowledge and understanding of organic structure have been infinitely extended by the means which geology has afforded of studying that structure in relation to its history in past time. In the hands of our great countryman, Professor Owen, physiology has assumed a new rank in science, leading us up to the very threshold of the deepest mysteries of nature. If the last few years had been marked by no other event in the advancement of science, there would have been enough to signalize them in the publication of his treatise on the "Homologies of the Vertebrate Skeleton;" and we may recollect with pride the fact of that high argument having been first opened at a meeting of the British Association.

A sad interest, indeed, attaches, in one direction at least, to the progress of our knowledge in geography. All serious doubt seems to have closed now over the grave of Franklin. Even in a year during which war has been claiming the noblest victims by thousands and tens of thousands, it would ill become this Association not to mark with an expression of our sorrow and admiration the self-sacrifice of that gallant band which has perished in the cause of science. But their devotion has been emulated, under a still higher stimulus, in the more successful career of others: and at last, in the discovery of the North-West Passage (still so-called in spite of its having been found impassable), the courage and endurance of Capt. M'Clure and his associates have ascertained with certainty a most remarkable fact in the physical conformation of the globe. Results of still larger, and certainly of more immediate interest, are being arrived at by the rapid march of African exploration—not, surely, before the time. Every part of the circumference of that vast continent has been either known or accessible to us for centuries. On its soil have flourished some of the most ancient and famous monarchies; and one of its great valleys is the fatherland of science. Yet up to comparatively recent times our horizon there has been bounded by the same sands or mountains which bounded the knowledge of antiquity, and we had almost as little acquaintance with its interior as had the Tyrian merchant when his eye rested of old on the peaks of Atlas. Nothing but familiarity with the fact could have reconciled us to the ignorance in which we have so long remained of one of the largest and most interesting regions of the world. That ignorance is at last being cleared away; and the exertions of many individuals, amongst whom the names of Mr. Galton, of Mr. Anderson, Dr. Livingston, Dr. Blaikie, and Dr. Barth, stand conspicuous, have contributed results of the deepest interest and importance. No man who values science can fail to appreciate the extension of our knowledge respecting geography even where, as in the Arctic regions, that knowledge is pursued simply for its own sake. But it becomes invested with tenfold interest when it brings with it the largest influence on the destinies of millions of the human race; and adds, as we may confidently hope it will ultimately do in the case of Africa, an inexhaustible field for manufacturing and commercial enterprise.

The kindred science of ethnology has received of late years great development, not only by its increasing store of facts, but by the more scientific use which is being made of facts which have been long familiar. The investigation of the laws which regulate the growth of language, promise to cast the most important lights on the history of our race; but the conclusions to which that investigation may lead are still matters of keen and anxious controversy, and are exposed to all that suspicion which has been directed against almost every science at some stage or other of its growth; and which, we must allow, every science has, at some stage or other, justified by hasty generalization and premature deduction.

Of all the sciences, chemistry is that which least requires to have its triumphs recorded here. The immediate applicability of so many of its results to the useful arts has secured for it the watchful interest of the world; and every day is adding some new proof of its inexhaustible fertility. There is one department of inquiry, and that perhaps the most interesting of all, I mean organic chemistry, which has received an especial impulse during the last few years, an impulse mainly due to the genius of one distinguished man, whom we have the honour of numbering among our guests upon this occasion. I think Baron Liebig will find in Scotland that kind of welcome which a man of science values most—a readiness to profit by his instructions, and an enlightened appreciation among the farmers of the country of the practical value of studying in their husbandry the laws which have been revealed by his research. I am reminded, through the kindness of Dr. Lyon Playfair, of some facts which give yet a more special interest to this subject in connection with our meeting here. It was to the British Association at Glasgow, in 1840, that Baron Liebig first communicated his work on the Application of Chemistry to Vegetable Physiology. The philosophical explanation there given of the principles of manuring and cropping gave an immediate impulse to agriculture, and directed attention to the manures which are valuable for their ammonia and mineral ingredients; and especially to guano, of which, in 1840, only a few specimens had appeared in this country. The consequence was, that in the next year, 1841, no less than 2,881 tons were imported; and during the succeeding years the total quantity imported into this country has exceeded the enormous amount of 1,500,000 tons. Nor has this been all: chemistry has come in with her aid to do the work of Nature, and as the supply of guano becomes exhausted, limited as its production must be to a few rainless regions of the world, the importance of artificial mineral manures will increase. Already considerable capital is invested in the manufacture of superphosphates of lime, formed by the solution of bones in sulphuric acid, the use of which was first recommended at the last Glasgow meeting. Of these artificial manures not less than 60,000 tons are annually sold in England alone; and it is a curious example of the endless interchange of services between the various sciences, that geology has contributed her quota to the same important end; and the exuviæ and bones of extinct animals, found in a fossil state, are now, to the extent of from 12,000 to 15,000 tons, used to supply annually the same fertilizing materials to the soil. The exertions of Professor Daubeny of Oxford on the same important subject, and the continued attention which he has devoted to it, have done much for the cause of agricultural chemistry in England; whilst the thanks both of practical and of scientific men are due to Dr. Lyon Playfair and Professor Gregory of Edinburgh, for those admirable translations of Baron Liebig's works, which have rendered them accessible to every English reader; and have thereby had no unimportant influence in extending the knowledge of the laws affecting both vegetable and animal physiology.

I am indebted to the same quarter for the mention of one remarkable instance of the manner in which—to use Dr. Playfair's words—"the overflowings of abstract science pass into and fertilize the field of industry." One of the newest and most obscure subjects of chemical research has been the discovery of certain conditions under which bodies, like in their composition, are nevertheless endowed with unlike properties, and thereby become convertible to new purposes. It is in the application of this principle that a gentleman of this city, Mr. James Young, has succeeded in obtaining the illuminating principle of coal-gas either in a solid or liquid state; and it has proved to be a substance of immense value for the lubrication of machinery, vast quantities of it being now manufactured and sold for that purpose.

He then alluded to Dr. Simpson's discovery of the application of chloroform, to the advance of statistical science, and to the establishment of a Meteorological Society for Scotland. He then remarked that the increasing employment of iron in shipbuilding has brought into corresponding notice the uncertainty which attends the action of the compass on board vessels of that construction. This important and intricate subject has been treated of by Mr. Archibald Smith of Jordanhill with all the resources of his high mathematical and scientific attainments, in publications which have appeared under the sanction and with the recommendation of the Admiralty. It will not fail to interest this great commercial city, whose freights are on every sea, that this question was taken up at the last Liverpool meeting by Dr. Scoresby, that it has continued to occupy his close attention, and that he intends to communicate to this meeting of the Association some of the valuable results of his investigations.

He then spoke of the assistance which science ought to look for from the Government, and afterwards referred in these words to our educational establishments:—The advancement of science depends, above all things, on securing for it a better and more acknowledged place in the education of the young. There are many signs that the time is coming when our wishes in this respect will be fulfilled. They would be fulfilled, perhaps, still more rapidly, but for the operation of obstructing causes, some of which we should do well to notice. How often do we find it assumed, that those who urge the claims of science are desirous of depreciating some one or more of the older and more sacred branches of education! In respect to elementary schools we are generally opposed, as aiming at the displacement of religious teaching; whilst in respect to the higher schools and colleges, the cudgels are taken up in behalf of classical attainments. A remarkable example of the influence of these feelings will be found in a speech delivered by Lord Lyndhurst during the late session of Parliament. With all the power of his dignified and commanding eloquence, he asserted the right of the elder studies to their time-honoured pre-eminence; and in the keen pursuit of this argument, even he was almost tempted to speak in a tone of some depreciation of those noble pursuits in which the University of which he is a distinguished ornament has won no small portion of her fame. But surely no enlightened friend of the natural sciences would seek to challenge this imaginary competition. Perhaps, indeed, like other zealous advocates, we may have sometimes overstrained our language, and have thereby given such vantage-ground to prejudice, that it has been enabled to assume the form of just objection. We cannot too earnestly disclaim the idea that the knowledge of physical laws can ever of itself form the groundwork of any active influence in morals or religion. Any such idea would only betray our ignorance of some of the deepest principles of our nature. But this does not affect the estimate which we may justly put on an early training in the principles of physical research. That estimate may be not the less a high one, because it does not assign to science what belongs to other things.

There is one aspect in which we do not require to plead the cause of science as an element in education, and on that, therefore, I shall not dwell. I mean that in which certain applied sciences are recognised as the essential basis of professional training; as, for example, when the engineer is trained in the principles of mechanics and hydrostatics, or the physician in those of chemistry. Of course, with every new application of the sciences to the arts of life, this direct influence will extend. But what we desire, and ought to aim at, is something more. It is, that abstract science, without special reference to its departmental application, should be more recognised as an essential element in every liberal education. We desire this on two grounds mainly—first, that it will contribute more than anything else to the further advancement of science itself; and, secondly, because we believe that it would be an instrument of vital benefit in the culture and strengthening of the mental powers.

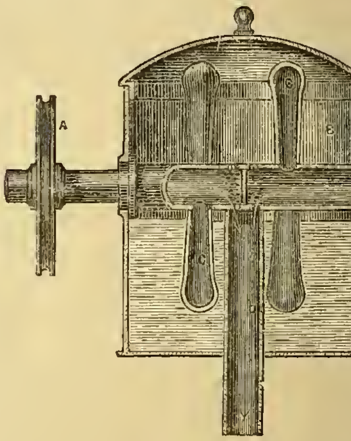
But, as regards both these great objects, we must remember that much will depend on the manner in which elementary instruction in science is conducted; on the conception, in fact, which we entertain of what science really is. Nothing can be easier than so to teach science as to feed every mental vice or weakness which obstructs the progress of knowledge, or blinds men to every evidence of new truths, in self-satisfied contemplation of the few they have already ascertained. May we not illustrate this by the effect which has not seldom been produced by the scientific education of professions? It is true, indeed, that professional men have often enlarged the field of science by the discovery of new and important truths. Some of the strongest-armed pioneers of science have been of this class. But how have their discoveries been too often received by their professional brethren! How many of them have been assailed by every weapon in the extensive armoury of prejudice and bigotry! What we want in the teaching of the young is, not so much the mere results, as the *methods*, and, above all, the *history* of science. How and by what steps it has advanced; with what large admixture of error every new truth has been at first surrounded; by what patient watchings and careful reasonings; by what chance suggestions and happy thoughts; by what docility of mind, and faith in the fullness of Nature's meanings; in short, by what kinds of power and virtue, the great men, aye, and the lesser men of science have each contributed their quota to her progress: this is what we ought to teach, if we desire to see education well conducted to the great ends in view. It is not merely for the sake of investing the abstractions of science with something of a living and human interest, that we should recall and revive these passages in her history; nor is it merely to impress her results better on the memory, as we fill up from biographies and other sources of information the meagre page of the general historian. It is for something more than this. It is both that they may be more encouraged to observe nature, and that they may better understand how to do so with effect. It is that they may cultivate that temper of mind to which she most loves to reveal her secrets. And as regards those whose own opportunities of observation may be small, it is that they may better appreciate the labours of others; and may be enabled to recognise, in the midst, perhaps, of much extravagance, the tokens of real genius, and in the midst of much error the golden sands of truth.

A word on the value of instruction in physical science, not merely with a view to its own advancement, but as in itself a means of mental training and an instrument for the highest purposes of education. It is in this latter point of view that its claims seem to be least admitted or understood. We may hear an exception made in favour of the exact sciences, which involve the application of mathematical knowledge, since this has been long recognised as requiring the highest intellectual exertion; but with regard to other sciences, how often do we hear them condemned as affording "mere information," and as tending in no sensible degree to strengthen and invigorate the mental powers! But, again I say, this would entirely depend on how science is to be taught—whether by a mere cramming of facts from manuals, or by explaining how and by whom former problems have been solved—what and how vast are other problems yet waiting for, and capable of solution. And even where the researches of physical science can do little more than guide conjecture, or illustrate merely what it cannot prove, how grand are the questions which it excites us to ask, and on which it enables us to gather some amount of evidence! In geology, is it true, or is it not true, that "we can see no trace of a beginning—no symptoms of an end?" To what extent, and in what sense are we yet entitled to say, that there has been an advance in organization as there has been advance in time? In physiology, what is the meaning of that great law, of adherence to type and pattern, standing behind as it were, and in reserve of that other law by which organic structures are specially adapted to special modes of life? What is the relation between these two laws; and can any light be cast upon it, derived from the history of extinct forms, or from the conditions to which we find that existing forms are subject? In vegetable physiology do the same or similar laws prevail—or can we trace others, such as those on the relations between structure, form, and colour, of which clear indications have already been established, in communications lately made to this Association by Dr. M'Cosh and Dr. Dickie of Belfast? In chemistry, how is it that some of the most powerful actions escape our finest analyses? In medicine, what is the action of specifics? and are there no more discoveries to be made such as rewarded the observation of Jenner, in the almost total extinction of a fearful and frequent scourge? It is in reference to such great questions, and ten thousand others equally interesting and important, that the pursuits of science call forth the highest activities of the mind, and exercise every power of thought and reasoning with which it has been endowed.

Indeed, it may fairly be questioned whether those sciences which are called exact, are necessarily the best preparation for the actual business of the world. It is the rare exception, and not the rule, when exact and perfect demonstration becomes applicable to the affairs of life. In general, men have to balance between a thousand probabilities, and to take into account a thousand conflicting tendencies. Surely there can be no training better than that which teaches us by what careful inductive reasoning—by what separation between permanent and accidental causes—by what constant reference from the present to the past, and from the past back again to the present, our existing knowledge has been attained in the paths of physical research. It is true, indeed, that where men's passions and prejudices are much concerned, no amount of teaching will ever induce them to follow or attend to the best methods of arriving at the truth. But even where there are no such disturbing causes, where moderate and candid men are expressing their sincere convictions, how constantly do we hear them ascribing effects to causes, which the slightest habit of correct reasoning would have been sufficient to dismiss! In questions of great social or political, as well as of philosophical importance, the want of such habit is often most painfully apparent, and serves in no small degree to retard the progress of mankind. The necessity of considering all questions with reference to fundamental principles or laws, and these again with reference to the disturbing causes which delay or suspend their operation, the mode of weighing evidence, and the degree of value to be attached to that which is of a merely negative kind—these are things of which we are perpetually reminded in the pursuits of science; and these surely are no useless lessons, whether in religious, social, or political affairs.

MONTHLY NOTES.

Tidmarsh's Self-Acting Lubricator.—This effective lubricator, which is made by the patentee, Mr. R. Tidmarsh, of Foxley Road, Surrey, consists of a plain cylindrical oil reservoir, in which is a short horizontal tubular spindle, constantly revolving, and carrying tubular dipping spoons, which lift up the oil as they come round, and deliver it to the tubular spindle, whence it finds its way down a central tube to the bearing beneath. Our engraving shows the instrument in vertical section, the oiling spoons being in partial section only. The lubricating action is derived from the cord pulley, A, on a short spindle, which passes into the side of the oil chamber. Inside the chamber the spindle is tubular, having upon it a set of tubular spoons, C, the inner ends of which open into the tubular spindle. As the spoons revolve, the oil is scooped up by them from the mass in the chamber; and it is passed down their cavities into the tubular spindle, and thence through perforations, as indicated by the arrows, into the stationary guide tube, D, leading to the bearing. The central portion of the tubular spindle has a division in it between the four spoons, to prevent the oil from passing from the forward motion spoons, and along the tubular spindle, down the back motion spoon. Mr. Tidmarsh has another form of lubricator, suited for a cam or eccentric movement; also another automatic contrivance, whereby the supply of oil can be adjusted from 1 drop to 150 drops per minute.



Pearce's Steam Hammer and Boiler-feed Apparatus.—Mr. J. C. Pearce, of the Bowling Iron Works, Bradford, has lately introduced several ingenious improvements in steam hammers. In one of his new arrangements of hammer mechanism, the framing is composed of a pair of vertical standards of the usual kind, with the working steam cylinder firmly bolted between the parallel cheeks of such frames. The steam cylinder is disposed low down in the framing, and alongside the hammer block, instead of being above it, as is usually the case. The hammer block, which is of considerable length, is retained in its proper line of vertical traverse by adjustable V plates, attached to the main standards, and fitting into corresponding grooves in the opposite sides of the hammer block. The latter has an upper projecting arm standing horizontally forward over the cylinder, to receive the upper end of the working piston, and in this way the piston works the hammer block, side by side with, and close to, the steam cylinder. The self-acting steam valve, as well as a hand valve, are situated at the lower part of the back of the steam cylinder, the working connections of the valve spindles being carried round to the front of the hammer block by suitable levers and rods. The steam and exhaust pipes spring up vertically at the back of the cylinder, a connecting branch being added near the top of the cylinder, for the purpose of equalizing the pressure on each side of the piston when the hammer descends. By the adoption of these modifications, the hammer possesses superior stability and firmness, whilst the absolute height of the machine is reduced, and a superior length of guide is given to the hammer block. This arrangement of hammer answers well for the general purposes of the iron-maker; but for puddling and shingling work, the same arrangement of cylinder and hammer block is fitted up in a one-sided overhanging standard frame, so that working access can be had to three clear sides of the hammer. The cylinder and hammer block are disposed between the projecting portions of the standards, the cylinder being thus capable of coming very near the floor level, to reduce the height of the hammer and secure stability. Instead of one steam cylinder, two may be used in this way for one hammer block.

Another branch of the invention relates to a feed-pump for feeding the boilers of steam hammers, as well as for other purposes. In this contrivance, three working pump cylinders are used, all set in one line, side by side. The centre barrel or cylinder is for steam, and the two external ones for water, each being fitted with a solid working plunger, all three of which plungers are connected by an overhead ornamental box, so as to work together. At the base of the pump is a long box or chest, on which the three pump cylinders stand, and to this base chest is attached a valve for admitting steam to and from the central plunger. This valve is actuated by means of mechanical connections, passing up to a tappet set on a suitable part of plungers' head-box. The water plungers are fitted with clack valves, as in the ordinary pumps, such clacks being placed either in the base box, or in a separate box, and connected with the pump by a branch pipe. The pump is worked entirely by the steam of the central plunger. The action of this steam lifts all three plungers together, until, at the required height, the tappet reverses the valve, and allows the steam to escape. The plungers then descend by their own weight, aided by that of the head-box. Instead of two water plungers to one steam plunger, a single water plunger only may be applied in this way. The true vertical traverse may be secured by a cross-head and guides in the usual manner. With such a form of pump, any available length of working stroke may be secured, together with the very desirable feature of a slow motion, whilst the plan is suitable for any size and purpose.

To get rid of the very great objection due to the presence of the water of condensation in the steam pipes of steam hammers, when the pipes descend at any part to a lower level than that of the steam boiler and hammer cylinder, a valved reservoir box is fitted up in connection with the steam pipes. This reservoir or chamber has an upper inlet and a lower outlet thoroughfare for the water. Over the latter, in the interior of the chamber, is an equilibrium valve, or a common valve, with a vertical spindle attached at the top. This spindle passes up and works freely through a cross-bar guide in a small narrow chamber, surmounting the reservoir's cover. Upon this valve spindle, between the valve and its spindle guide, is a large float of firebrick or other suitable material, the weight of this float being taken from the valve by the effect of a helical spring on the upper end of the spindle, and resting by its lower end upon the cross bar. The float may be allowed to press down the valve to any required extent by adjusting the spring accordingly, the latter having a pair of lock nuts for the purpose. As the water of condensation flows along the supplying steam pipe of the steam hammer, it gradually accumulates in the reservoir, until it elevates the float, and thus raises the discharge valve. This apparatus is automatic under all fluctuations of pressure, is applicable to a variety of purposes, and is especially well suited for discharging the large quantities of water constantly accumulating on starting the steam hammer.

As the pressure of steam required for steam hammers is considerably higher than that necessary for other purposes for which steam from the same boiler is frequently supplied, a regulating apparatus is employed, for the purpose of reducing the pressure of the steam required for ordinary purposes. This apparatus consists of a double beat or equilibrium valve, placed vertically in any convenient part of the steam pipe. The spindle of this valve passes through a stuffing-box, and is attached to one end of a lever, the other end of which is attached to a plunger, also working through a stuffing-box into the steam pipe, the fulcrum of the lever being situated between the valve and the plunger, so that when the latter ascends by the force of the steam beneath it, the former descends, and, by partially closing the aperture of the steam pipe, prevents the freer passage of steam from the boiler. The amount of steam pressure on the plunger side of the valve is regulated as required, by means of a weight or spring balance attached to the lever.

Limited Liability Act.—We present our readers with a short abstract of this important act of Parliament, which, however, we regard as only the commencement of legislation, to enable small capitalists to invest their money with safety to themselves and advantage to the community. *What Companies are entitled to the benefit of the Act?*—Joint stock companies, not being assurance companies, with shares of not less than £10 each, with at least 20 per cent. paid up, the shareholders being not fewer than 25; such a company may obtain a certificate of registration with limited liability. Existing joint stock companies, with the same exception as before, may, with the consent of three-fourths in number and value of the shareholders, and by taking the steps described in the act, become joint stock companies with limited liability, the value of the shares, the number of shareholders, and the amount paid up being as previously mentioned. Every such company must make it appear in its deed of settlement, upon its common seal, and in all its proceedings, its sign-boards, invoices, notes, bills, &c., that it is a company with limited liability, and the name of the company must invariably terminate with the word *limited*. *Liabilities of Shareholders.*—In case such a company should become involved in debt, the property and effects of the company are first liable to the creditors, and then the shareholders, but to the extent only of that portion of their shares remaining unpaid. If the directors shall pay a dividend to the shareholders when the company is insolvent, or such a dividend as will make it insolvent, they shall be liable too as creditors of the company, to the amount of the dividends paid under such circumstances. Directors not consenting to the payment of a dividend under the circumstances aforesaid not to be liable. The shareholders are not to borrow money off the company; if directors make a loan to a shareholder, they are rendered liable for the debts of the company contracted before repayment of the loan, to the amount of the money so lent, and the interest accruing due thereon. *Winding-up.*—Whenever, on taking the yearly accounts of such company, or by any report of the auditors, it appears that three-fourths of the subscribed capital of the company has been lost or become unavailable, the trading and business of the company shall forthwith cease, and the directors shall take proper steps for the dissolution of the company and the winding up of its affairs. *Penalties.*—Pecuniary penalties, recoverable as debts due to the Crown, are imposed upon directors, in case of their not attending to the provisions of the act, as to painting up the name of the company, using improper seals, issuing notices, &c., not having the name properly mentioned.

Marine Memoranda.—The *Eckford Webb*, which recently arrived at Queenstown, Cork, from America, has, properly enough, attracted great attention amongst nautical men. She is what the Americans call tern-rigged, with three masts, all of the same length, 84 feet, carrying three fore and aft mainsails, over which are three gaff topsails. The main mizen topmast has also staysails, but she has no square sails. Each mast has a hoisting winch, such as we are persuaded every ship in our service ought to possess. With this simple mechanical aid, two men can hoist the sails in five minutes. Her log, on the run from America, shows 309 miles in 24 hours; and during some of her hours she performed 16 miles. The run from Charleston was done in 21 days. She was built by Mr. Thomas Dunham of New York. Her dimensions are—length, 137 feet; breadth, 30 feet; carrying 494 tons, with a draught of 11 feet 6 inches. Her crew consists of but six men.

A great military floating factory, the *Chasseur*, an iron ship, has just been fitted out by Messrs. T. & W. Smith, of St. Peter's Dockyard, Newcastle, for service at Balaklava. This naval workshop comprises an engineer's fitting shop, a smithy, a foundry, a sawmill, and carpenter's shop, and has on board mechanics, and all the most improved machinery for carrying out each of these branches effectually. There are on board also other useful workmen, including a brickmaker, wellborer, and miner; and the internal arrangements for their accommodation on board are excellently contrived, including a bathroom, ventilation by fan blast, messing and sleeping galleries, manager's office, and foreman's apartments and factory storerooms. There is on board a portable engine, shafting, and standards, so that when occasion serves a plant of machinery may be worked on the shore. Model huts of wood, canvas, and iron are also sent. All this has been compressed within the limits of a 70 horse steamer. To Colonel Tulloch, Captain Collinson, and Mr. John Anderson, the practical engineer at Woolwich, great credit is due for the excellence of these arrangements.

An American clipper ship, the *Lorenza*, has lately attracted scientific attention in the Clyde. She is from the State of Maine, and is a handsome vessel of 1,069 tons, 200 feet long on deck, 38½ feet broad, and 23½ feet deep. A very large keelson stands 5 feet above the bottom, giving immense strength, a point which is well looked to throughout the hull, for the plank lining of the hold has timber in it from 12 to 4 inches thick. The rudder stock comes up above the poop, and is turned by a short wooden tiller strapped to the head and worked by tackles, the falls of which are passed round a drum on the steering wheel spindle. The iron strapped blocks have their straps inside, extending down far enough just to receive the sheave pin. There is thus no strain whatever on the wood, and by simply knocking out the steel pin, the sheave and the strap at once come away. The *Lorenza* has just been fitted up with Howes' patent topsail, as illustrated at page 153 of our seventh volume. The chain stopper is made with a cast-iron detent or pall, pointed so as to haul over the chain. As the chain passes, the free end of the pall slips over the edge links and holds in the flat ones. To show what mechanical appliances can effect, we may state that fifteen men suffice to navigate this great ship.

The abstraction of commercial shipping for war purposes has caused a good deal of bustle amongst the shipbuilders in various localities. Amongst the rest, the Welsh ports have felt the benefit of the demand thus arising. A large iron vessel is just being completed at Newport, and at Neath a ship of between 3,000 and 4,000 tons has been commenced. The coasting vessels here are also being largely increased in tonnage.

The *Batavier*, a well-known Rotterdam steamer, after being in service for 26 summers, has been withdrawn, and is about to become a coal depôt in Rotterdam, but the Netherlands Steamboat Company, to keep up the name, have built a new *Batavier* to take up the trade. Her trial trip came off yesterday from St. Katharine's Dock Steam Wharf to the Nore, accompanied by the Dutch Consul, the managing director, and a number of gentlemen from the city. This vessel was built at the port of Fyneoord, on the river Mass; her tonnage, builders' measurement, is 650 tons; length, 218 feet; of 250-horse power; low pressure direct-acting engines; and the speed attained at the measured mile was 12 knots. The whole of the internal arrangements are of the most improved order for the comfort and general accommodation of passengers. The lower cabin is parted down the centre by a partition, with the sleeping berths arranged on either side—a practice which deserves the attention of builders and fitters, the motion of the ship being less felt than when the berths are placed against the vessel's sides.

Ten Years of Free Trade.—During this period England has increased her exports from £47,000,000 to £78,000,000; her imports from £65,000,000 to £109,000,000; the amount of shipping which she employs to carry on that trade from 7,678,791 tons to 13,602,750 tons. This has been accomplished in the face of a reduction in taxes, extending over a period of 11 years, amounting to £10,600,000, and effected without injury to the revenue of the country; while, during the same period, wages have risen, crime diminished, and ablebodied pauperism almost ceased.

East Indian Iron.—We are glad to be able to add to our former good reports of the manufacture of East Indian iron. There will very shortly be five furnaces at work at Beypore. The ores of Malabar have proved as tractable in the smelting process as those of Salem; and the produce has quite sustained the expectation of the board, whether as regards the yield or the quality of the iron for forge or foundry purposes. In proof of this, during four weeks of the month of January last, 135 tons of pigs of an excellent quality were yielded at Beypore by 216 tons of ore and 209 tons of charcoal fuel. In other words, about 32 cwt. of ore and 32 cwt. of fuel, costing not more than 5s. 3d. and 18s. 6d. per ton respectively, according to the 'cost sheet' furnished, have been found sufficient to make a ton of pig-iron, the expenditure on account of labour at the furnace being at the same time at the rate of 8s. 10d. per ton of pig. The Madras railway from Beypore is progressing with great rapidity; and the company has contracted for all the wrought and cast iron work of the Beypore station.

Association for the Prevention of Boiler Explosions.—This Lancashire and Yorkshire institution has started with great energy. Since the 25th of June last there have been made, under the auspices of the association, 203 inspections, comprising 696 boilers. The report goes on to state, that of these eight boilers in a dangerous state have been met with. In seven of these the furnaces had been injured from deficiency of water, and in the other from deposit of scale on the plates. In five other cases, the safety-valves were out of order, and would not act; and in many other instances they were considerably overweighted. Some boilers, not adapted to so high a pressure as that which they were working at, have been already strengthened, and others are undergoing similar alterations. There have been no cases of explosion or collapse in boilers of any of the members.

Self-Acting Coupling for Railway Carriages.—An ingenious and convenient system of coupling railway carriages together has been introduced on the American lines by Mr. Hopkins of Elmira, with considerable success. The new modification relates to the central traction connections alone, which are ordinarily made in America, as represented in our sketch, fig. 1, which is a perspective view of the coupling-box, with its link and pin detached. Fig. 2 is a sectional view of the improved coupling, the box end being trumpet-mouthed, for directing the free uncoupled link into its place in coupling, the actual coupling throat being greatly narrowed. Immediately behind this narrow throat, is a triply-grooved piece of metal, fig. 3, which is kept started forwards by a helical spring, concealed in the wood of the main coupling piece. So long as the vertical coupling pin is down in its holding position, it keeps the grooved head-piece back; but when the pin is elevated preparatory to coupling, the spring action brings forward the grooved head, so as to support the pin in the position which we have sketched. Now, when the next carriage in the train comes up to be coupled, the connecting link upon that carriage being caught by the trumpet mouth, is passed into the narrow throat, and, catching in one of the grooves of the spring-piece, its entering pressure forces back this piece, when the pin is cleared from it. The pin can thus drop into the entered link, and complete the coupling. Should the link be first placed in this part of the coupling, its overhanging end may be elevated to the proper level, and retained there by one of the grooves in the head. By this system, the risk of injuring the attendants between the carriages may be practically abolished.

Fig. 1.

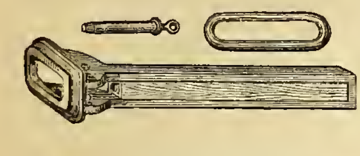


Fig. 2.

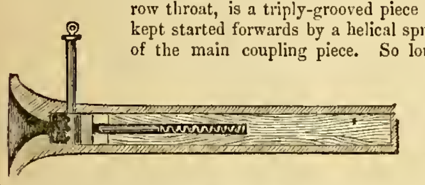
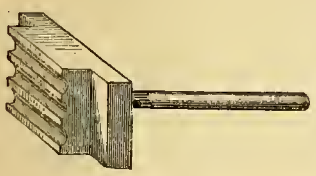


Fig. 3.

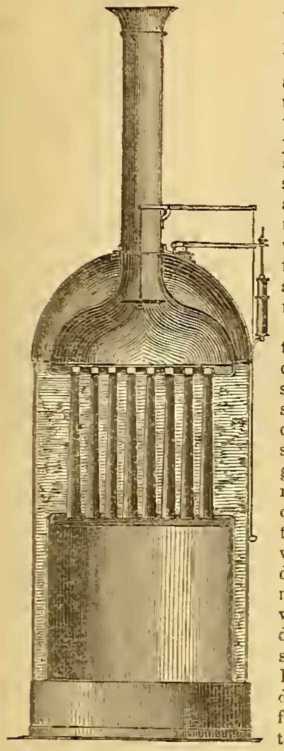


Aluminium.—This is the metal which, by uniting with oxide, forms the universally distributed earth, alumina, the chief constituent of clay, and an ingredient of many gems and minerals. The metal was discovered so far back as 1808, but it has never been hitherto obtained except in very small quantities. M. Deville, a French chemist, has lately discovered a method of obtaining it in larger pieces; and a bar of it has been sent to the Polytechnic Institution, London, by command of the Emperor Napoleon. If the process proves to be easy and cheap, the metal is likely to be extensively used, since its properties are such as to render it capable of application to very many purposes. Its colour is white, with a faint blue tinge. It is highly malleable and ductile, a perfect conductor of electricity. It melts at a temperature rather higher than that required to melt zinc (773° Fahr.), and resists the action of sulphuretted hydrogen, of water, and of oxygen, if not heated. It is of very light weight, its specific gravity being only 2·60, that of gold being 19·26, and of iron 7·79.

Sutton's System of Printing Photographic Positives.—To Mr. Thomas Sutton of St. Brelade's Bay, Jersey, we owe an important step in photography, just given to the world as the result of the inventor's continued study of the subject of multiplication from negatives. Abandoning sun printing, he adopts the gallic acid development—the images thus obtained being coloured with gold. In this process no salt is used, organic matter only being employed. The paper is immersed in a bath containing but 3 per cent. of silver, contrived to remain at a uniform strength from the beginning to the end. The exposure is made in ordinary daylight, until the outside border of the print assumes a certain tint—determined by the inventor—varying with the negative, but easily ascertained by a trial. The time ranges from half a minute to a quarter of an hour. In the development gallic acid alone is used, five minutes being required for this stage. The picture, at first but partially visible, comes out gradually, the development being suspended at any moment by washing in water; after which, all that has come out stands in the finished picture, without any loss in the subsequent baths. The print is a faithful reverse of the negative, and any unavoidable exposure due to imperfections in the negative does not cause any reddening, as in the collodion process. The outside margin always blackens. The colouring is effected in a bath of hyposulphite of gold, without any acid, any shade between a brown and a violet being obtained. The fixing is performed in a fresh bath of hyposulphite of soda; the entire operation from the commencement occupying only ten minutes. Instead of being superficial, as in sun printing, Mr. Sutton's pictures are dyed into the body of the paper, and the back exhibits the image nearly as strongly as the face, the paper being semitransparent, and containing no opaque chloride. All the silver coming under the lights of the negative is duly affected by the light, and is subsequently acted on by the gallic acid. There are many points in favour of Mr. Sutton's process; and he offers handsomely enough to bring all doubtful assumptions to the test of practice, by printing from any negative submitted for the purpose; his resulting positive being then compared with that obtained from the same matrix by any other process. If the operation is as certain as he describes it, he has, undoubtedly, removed one great barrier to the progress of this elegant art.

East Indian Substitutes for Russian Hemp.—A recent work of Dr. Royle—"The Fibrous Plants of India fitted for Cordage, Clothing, and Paper"—enters fully into this important subject, and we hope that the information it gives will induce our enterprising merchants to prosecute the matter to a successful issue. Dr. Royle is an accomplished botanist, who resided several years in India, and he is well acquainted with the subject he writes upon. It appears that the exports of fibrous materials from India increased sixty-fold between 1831 and 1851, in which last year 590,923 cwt. of them were sent to us. Between the same years the exports from Russia only increased one-third. Indian hemp is of very good quality, and is already very largely cultivated, but unfortunately for the purpose of obtaining narcotics, not for its fibre. In the Himalayas hemp grows wild, but, in order to turn it to account, better means of communication than now exist are required. An untwisted strand of hemp, from Kote Kangra, on the Himalayas, bore a weight of 400 lbs. without breaking, whilst a similar strand of clean Petersburg hemp broke with a weight of 160 lbs. Besides hemp, there are many other wild plants which produce fibre of excellent quality, and there can be no doubt that if the cultivation of them were attended to, we should derive a supply from our Indian possessions more than sufficient for every possible want. The pine-apple, the agave, the banana, a *Sanseviera*, a *Corchorus* (the Jute plant), and two *Crotolarias* (the Sun plant and the Jubbulpore hemp plant), yield fibres of more or less excellence, some of them superior to the best Russian produce. The fibre known as China grass or Rhœa fibre (yielded by a plant of the Nettle tribe), is not only stronger and more durable than hemp, but its fineness and beauty entitle it to be substituted for the highest priced flax. Large supplies may be easily obtained from China and other Eastern countries, and its cultivation might be readily introduced into India. The fibre offered at a moderate price would be largely demanded in England, and the attention of Indian agriculturists to this plant would be well rewarded. The value of the fibre may be judged of from Dr. Royle's statement, that similar untwisted strands of clean Petersburg hemp and wild Rhœa fibre from Assam, broke with weights of 160 lbs. and 343 lbs. respectively. It is, of course, highly desirable that machinery should be employed in India to reduce the cost of carriage both in the country and across the ocean; but the machinery required is neither complicated nor costly. We hope that the attention of the new governor-general, who goes out with the character of a good business man, has been called to this matter, and that he will devote himself, on his arrival at the seat of government, to the development of the fibre cultivation, by which the resources of India may be enormously increased, the resources of Russia proportionately crippled, and a very great benefit effected for the people of this country, not only by the increase of commerce between two branches of the empire, but by the abundance and economy of the supplies.

Leeches in France.—In certain parts of France, the breeding and bringing up of leeches are carried on as a regular business, and to a considerable extent. For example, there is a marsh near Rambouillet (Seine et Oise), about two acres and a half in extent, where in artificial pools, twenty feet by ten, and with a depth of between three and four feet, stocks of leeches are kept until ready for market. In the middle of this marsh there is a hut, in which is stationed a man whose duty it is to protect the pools from pilferers, and to drive away the birds that would otherwise come to feed upon the leeches. To show the necessity of such a guardian, it may be stated, that 200,000 leeches were once missed from a marsh after the visit of several flocks of wild ducks. Much care has to be taken to prevent the ravages of water rats, moles, and other vermin. The marsh to which we have referred, is surrounded by a ditch filled with water, which helps to exclude some of the vermin that attack leeches. Fresh blood is, as may be supposed, a favourite food of leeches, and they are supplied with it periodically, by various means, some of which seem rather cruel. One method is to drive into the marsh old worthless horses, upon which the leeches soon seize, and not unfrequently bleed them to death. It is considered the best plan to give them a feed of blood in the autumn. They then proceed to bury themselves during the cold months, and emerge on the return of the warm season. The cocoons or eggs have then the whole of the warm part of the year for their hatching. During the first two years of a leech's existence, its growth is very slow. In the next two years, it increases tenfold in weight. Sometimes the cultivator of this branch of industry will purchase very young leeches in spring, giving them three feeds of blood between that time and their hibernal sleep. For this purpose, they are drawn out of the pools, to which they are returned when fed. Little galleries are sometimes constructed to which the leeches can retire to deposit their cocoons or eggs, it being much easier to gather these cocoons when so deposited, than when left indiscriminately in the corners of the pool. Some cultivators collect the cocoons and have an ingenious method of hatching them. Notwithstanding the pains that are taken to protect the leeches from harm, great losses frequently occur, particularly in severe winters, when hundreds of thousands will die off, and when some marshes are thus entirely depopulated.



Chaplin's Portable Steam Boiler.—We last month noticed one of the forms of portable steam boiler manufactured by Mr. Chaplin, for the purpose of showing the application to it of his system of forced combustion; and we now give a vertical section, showing the internal arrangement of another modification possessing some meritorious features. The firebox is, as usual, in the lower part of the furnace, surrounded by water spaces, and is covered by a horizontal tube plate, a second tube plate being placed at some distance above, and open to the flue or chimney. The tubes employed in this boiler are tapered, being wider at their lower extremities. They are fixed by nuts at their upper ends, and are made so that they can be tightened up endways if necessary.

Cotton Cultivation in India.—Some time ago, attempts were made to introduce the cultivation of cotton into India, grown from seed brought from America; and the result showed that the cultivation ought to be proceeded with, the price obtained for the American seed cotton being higher than that of native grown cotton. It is now complained, that by reason of indifference on the part of the higher officials in India, and prejudice or supineness on the part of the subordinate ones, the cultivation, which once wore so promising an aspect, is declining. The first place where the experiment was tried, under favourable circumstances, was at Dharwar, in the Southern Mahratta district. The produce of the American seed sold in Manchester at a price 50 per cent. higher than the best native cotton of that district; and in Bombay, the difference has been for some years 10 or 12 per cent. in favour of the Dharwar American seed cotton over the best native grown cotton of Western India, and 25 per cent. over the best native cotton grown in the Southern Mahratta, or in Mysore, or in the Nizam's country. An experiment to cultivate the American seed cotton was also made by the Indian government at Kandeish, but this has been abandoned, on account of the report that no prospect of benefit to the country was presented. This result is said to be mainly owing to the appointment of a gentleman strongly prejudiced against the introduction of American seed to superintend the experiments. It is to be hoped that the government, having had its attention called to the matter, will not allow a promising branch of agricultural industry to be extinguished by the ignorance or prejudices of the officials, but will direct the experiments to be carried on under the superintendence of those best capable of managing them. The resources of the Indian peninsula are immense, but they require careful investigation and energetic prosecution on the part of the government and its officials.

Paper Manufacture.—In 1854, the quantity of paper manufactured in Great Britain amounted to 177,896,224 lbs., or 803,100 tons, the duty on which, at 1½d. per lb., amounted to £1,111,851. The consumption of paper gradually increases, but the supply of paper-yielding material does not increase in the same proportion. Hence the rise in the price of paper within the last few years. Our periodical literature has largely extended of late years. The *Times* newspaper alone consumes nearly nine tons of paper daily. The Americans buy considerable quantities of rags, both in our own market, and in those Continental markets whence we derive part of our supply—viz., between 8000 and 9000 tons a year. Between 1841 and 1850, our exports of rags only amounted to 295 tons a year, but from 1851 to 1853 they amounted to 1580 tons a year. The price of rags of the first quality advanced from 26s. per cwt. in 1852 to 33s. in 1854, and of the fourth quality, from 7s. per cwt. in 1852 to 10s. in 1854. It has been calculated, that in consequence of the war with Russia our importations of flax and hemp from that country are less by at least 100,000 tons than in years before the commencement of hostilities. In 1853, we received from Russia flax and hemp to the value of £3,395,635. of the former 64,399 tons, and of the latter 41,819 tons having come to us. Besides this increase in the cost of the raw material of paper, the various articles used in the manufacture have advanced in price. To remedy the evils of limited quantity, many expedients have been adopted, but as yet without much success. A small quantity of paper is made from straw, and M. Helin of Brussels has recently obtained a patent in this country for improved processes in its manufacture, which are likely to reduce the difficulties, and consequently the expense, considerably. M. Helin's process is described in our last number. Common flax is also manufactured into paper. Many persons are looking to India and the West Indies for the supply of raw material required to bring back paper to its former price. The banana and the sugar-cane offer, it is said, an unlimited quantity of materials for paper. Difficulties in the bleaching, however, stand in the way as to the latter. It must always be kept in mind that, however cheap the raw material may be, the expenses of manufacture may be too great to allow a profitable use to be made of it. It is stated that the consumption of paper in France is about 4 lbs. each person per annum, in Great Britain about 4½ lbs. each person per annum, whilst in the United States of America each member of its free population consumes 13½ lbs. yearly. The vast quantity of paper manufactured in America is chiefly used by the newspapers, the name of which is Legion.

LAW REPORTS OF PATENT CASES.

Lister *v.* Eastwood—Chancery.—Patents were obtained in 1850 and 1852, by S. C. Lister, in conjunction with other persons, for improvements in preparing and combing wool and other fibrous materials. The invention consisted in a new combination of old parts, the advantage being that all the wool, long and short, was transferred by one process on to the travelling comb, and that the long wool was drawn off in one direction, whilst the noil and the short wool went in another, by a continuous process. A machine, subsequently constructed, known as "Preller's," was alleged to be an infringement of Lister's, and an action was brought by the assignees of the patent against certain persons for using that machine. This action was referred to a barrister, who held the patent good, and Preller's machine an infringement of it. Another machine had been constructed, known as "Crabtree's;" and this was alleged to be only a colourable variation of Preller's, and, therefore, a violation of the plaintiff's patent rights. Suits were thereupon commenced by Lister against certain persons who had used Preller's and Crabtree's machines, and an injunction was prayed for to restrain them from that illegal use. After argument, V. C. Page Wood said that he would grant the injunction as against those defendants who had used Preller's machine, for the arbitrator's award was decisive, and had established the validity of the plaintiff's patent, and that Preller's machine was an infringement of it. With regard to those defendants who had used Crabtree's machine, he refused the injunction, but directed them to keep an account of all the wool combed by them by means of that machine. The plaintiff might bring such actions at law as he might be advised, with the view of establishing his rights against these defendants. Leave to inspect the working of the machines might be applied for when deemed advisable.

Crooke and Cochran *v.* Rylands.—This was an action tried at the Liverpool assizes for the infringement of a patent for improvements in weaving looms, taken out in September, 1845, by Eccles, Crooke, and Lancaster. Crooke, one of the plaintiffs, was a working handloom weaver, who, during his confinement to the house through illness, invented certain contrivances for obviating defects in the construction of looms. His contrivances having been improved by two other people, a patent was taken out in their joint names. By several subsequent transfers, the whole interest in the patent became vested in the present plaintiffs. It appeared that part of the invention consisted in the use of an improved check-strap for preventing the rebound of the shuttle. The defendant, an extensive cotton manufacturer, was alleged to have infringed the plantiffs' right by using this improved check-strap. In the course of the cross examination to which the plaintiffs Crooke, and Lancaster, another of the inventors, were subjected, it transpired that certain inventions claimed in the specification had not been made by any of the three patentees; but that they had been made by one Bullough, who had them introduced into the specification for his own purposes. This being the case, the judge could only take one course, and that was to nonsuit the plaintiffs; at the same time suggesting that a disclaimer should be entered, so as to cut Bullough's portion of the inventions out of the specification, and thus make their case good in any future action for an infringement.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded May 16.

1110. John Knowles and Edward T. Bellhouse, Manchester—Improvements in the manufacture or working of marble, stone, glass, and similar materials.

Recorded June 5.

1287. Alexander Morton and Edmund Hunt, Glasgow—Improvements in motive power engines.

Recorded July 7.

1523. John Gedge, 4 Wellington-street South, Strand—Improvements in photographic glasses.—(Communication.)

Recorded July 10.

1537. François Loret-Vermeersch, Malins, Belgium—Improvement of looms for weaving.

Recorded July 18.

1608. Walter C. Thurgar, Norwich—Invention of the preservation of the fluid substance of fresh eggs.

Recorded July 19.

1638. Samuel Stocker, Brighton—Improvements in waterclosets, and in pumps and cocks for supplying water to the same, and for other similar purposes.

Recorded July 20.

1639. William A. Gilbee, 4 South-street, Finsbury, and 39 Rue de l'Echiquier, Paris—Invention of the employment of a new material in the manufacture of paper.—(Communication.)

1645. Francis Moll, Annaberg, near Godesberg, Prussia—Invention of the employment of new materials in the manufacture of paper.

Recorded July 23.

1663. Charles Goodyear, 25 Avenue-road, St. John's-wood—Improvements in the manufacture of wheels for carriages and other vehicles where india-rubber is used.

1665. Charles Goodyear, 25 Avenue-road, St. John's-wood—Improvements in bands or straps for confining or holding papers or documents and other articles where india-rubber is used.

1695. James Beattie, 26 Hans place, Chelsea—A combination or contrivance of a folding mattress (with or without a tent attached), but, ambulance for conveyance of wounded or sick persons, pontoon raft and boat, portable cistern and bath.

Recorded July 26.

1697. John Hunt, New Kent-road—Invention of an expanding and contracting self-fastening band.
1699. William Brown, Bradford—Improvements in machinery or apparatus for combing wool and other fibrous substances.
1701. Christopher Thompson, South Shields—Certain improvements in furnaces with a view to the prevention of smoke.
1703. Charles Goodyear, Avenue-road, St. John's-wood—An improvement in the manufacture of gunpowder.—(Communication.)
1705. William Mardon, Christchurch-chambers, Newgate-street—An improvement in treating garancine.—(Communication.)

Recorded July 27.

1707. Charles Hodges, Manchester—Improvements in machinery or apparatus for knitting plain, ribbed, or figured hosiery.—(Communication.)
1709. Peter Effertz, Aix-la-Chapelle, Prussia—Improvements in machinery for cutting, creasing, or marking paper, card, and pasteboard, and other like substances.
1711. Charles F. Kirkman, Argyle-street, Regent-street—Certain improvements in machinery for spinning and twisting cotton, silk, flax, wool, hemp, and other fibrous substances.
1713. Andrew Smith, Manchline, Ayrshire—Improvements in portable cases or holding receptacles for cigars, spectacles, cards, cutlery, and other articles.

Recorded July 28.

1717. Henry H. Barry, Bedford-street, Strand—Improvements in machinery for combing and carding wool, flax, mohair, and other fibrous substances.
1719. John Hyde, Sheffield—Improvements in furniture-castors.
1721. William Brownfoot, Leeds—A new or improved instrument or apparatus for raising, lowering, and adjusting blinds, maps, and other such like articles.
1723. Frederick Willis, King-street, St. James's—An improvement in the manufacture of wine bottles.
1725. Charles Goodyear, Avenue-road, St. John's-wood—Improvements in manufacturing covers for floors, when compounds of india-rubber are used.

Recorded July 30.

1727. Joseph M. Fillier, Paris, and 4 South-street, Finsbury—Certain improvements in looms for weaving.
1729. William F. Coles, 61 Paul-street, Finsbury—An improvement in the manufacture of boots and shoes.
1731. Thomas Clunes, Aberdeen—Improvements in pumps and fire-engines.
1733. James H. Whitehead, Mowville, Burley, Otley, Yorkshire—Improvements in the construction of steam boiler furnaces.

Recorded July 31.

1734. Herbert Mackworth, Clifton Wood House, Clifton, Gloucestershire—Improvements in washing and separating minerals and other substances in a granular or pulverulent state.
1736. Hall Colby, New York—Improvements in the construction of an instrument for taking altitudes' angles, called an improved altimeter or self-adjusting quadrant.
1738. Louis N. Dupont, Louviers-town, France—Improvements in making an improved fabric called "drap de soie."

Recorded August 1.

1741. Samuel Mellor, Salford, and Thomas Young, Manchester—Improvements in machinery for supplying water to steam boilers.
1742. Richard A. Brooman, 166 Fleet-street—Certain improvements in manufacturing paper, pasteboard, and pulp.—(Communication.)
1743. John Clarke, Leicester—Improvements in machinery for making loop fabrics.
1744. Charles Vaughan, William J. Vaughan, and Richard Vaughan, all of Birmingham—An improvement or improvements in making and attaching the handles of iron bowls and other iron vessels.
1745. Georges Bufnoir, Lyons, France, and 32 Essex-street, Strand—Certain improvements in stopping bottles and other vessels.
1746. Leon Glukman, Dublin—An improved box for papers, letters, and other documents.

Recorded August 2.

1747 Alexander Allan, Perth—Improvements in the valve gear of locomotive and other engines.
1748. John Stanley, 224 Whitechapel-road, St. Mary Whitechapel—Improvements in weighing machines, and weights used with the same, which improvements apply principally to weigh-bridges, weighing cranes, and the class of weighing machines acting upon levers, steelyards, &c.
1749. James Saunders, Newgate-street—An improved roller for cloths and other fabrics.
1750. Samson Woller and Illingworth Butterfield, Bradford—Improvements in machinery for weaving figured fabrics.
1751. Rudolph Bodmer, 2 Thavies-inn, Holborn—Certain improvements in rotatory steam-engines.—(Communication.)
1752. Richard A. Tilghman, Philadelphia, U.S.—Improvements in the manufacture of candles.
1753. Daniel Airey and William H. Lackabane, Preston—Improvements in rotatory steam-engines.

Recorded August 3.

1755. Henry H. Watson, Bolton-le-Moors—Improvements in the manufacture of coke.
1756. Joseph Lane, Birmingham—An improvement or improvements in the manufacture of gold leaf.
1757. Auguste E. L. Bellford, 32 Essex-street, Strand—Certain improvements in grinding mills.—(Communication.)
1758. Jean B. Mourguet, Paris, and 32 Essex-street, Strand—Invention of an apparatus for the destruction of the weevil, its larvæ and its eggs, whilst drying the corn, without injuring its ordinary properties.
1759. George H. Fullard, Thorney, Cambridgeshire—An improved pin for thatch coverings for stacks and roofs.
1760. Frederick R. A. Glover, Endell-street—Improvements in the means of carrying knapsacks and other burthens upon or from the shoulders.
1761. John C. A. Pfaff, Wiesbaden, Grand Duchy of Hesse—Improvements in obtaining and applying motive power.
1762. Richard A. Tilghman, Philadelphia, U.S.—Improvements in the manufacture of alkalies and alkaline earths.
1763. Henry J. Betjemann, 449 New Oxford-street—Improvements in extending tables.—(Communication.)
1764. Charles Ritchie, New Palace-yard, and George Ritchie, Millbank-street—Improvements in preparing cork, and other materials for stuffing.
1765. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture of metallic waterproof fabrics or materials, and in the applications thereof.—(Communication from Nicolas E. T. Petin, Montmatre, near Paris.)
1766. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the purification of gas for illuminating purposes, by separating therefrom the carbonic oxide, and in the application of such carbonic oxide to heating purposes.—(Communication from Mathieu L. Pujol, Paris.)
1767. Robert Richardson and Walter Greenshields, Isle of Man—Improvements in chenille fabrics.
1768. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Invention of a new material for ornamenting various articles.—(Communication from Charles V. Beslay, Paris.)

Recorded August 4.

1769. Henri L. R. Perrot, Chaux de Fonds, Switzerland—An improved escapement for chronometers.
1771. Edward Whiteman, Riverhead—An improvement in the manufacture of waterproof coats, boots, capes, overalls, and other garments.
1772. John Anderson, Edinburgh—Improvements in shirts.
1773. Edward Hall, Dartford—Improvements in the manufacture of gunpowder.

Recorded August 6.

1774. John Macintosh, Great Ormond-street—Certain improvements in the application of incendiary materials to be used in warfare.
1775. John Gedge, 4 Wellington-street South, Strand—Obtaining and applying motive power.—(Communication.)
1777. John Avery, 32 Essex-street, Strand—Improvements in windlasses for ships and other purposes.—(Communication.)
1778. Henry Gilbee, 4 South-street, Finsbury, and 39 Rue de l'Echiquier, Paris—Certain improvements in constructing flat-bottomed boats.—(Communication.)
1779. Fischer A. Wilson, Islington—A portable cooking apparatus, suitable for campaigning purposes.
1780. John Platt, Oldham, and John Hibbert, Ashton-under-Lyne, Lancashire—Improvements in mules for spinning and doubling, which improvements are also applicable to other machines in which clutch boxes are used.
1781. Henri A. Pradel, Paris—Certain improvements in twisting textile goods or fabrics.—(Communication.)
1782. John Lilley, Birkenhead—Improvements in obtaining textile fibres, and in the manufacture of pulp and dye.

Recorded August 7.

1783. James Hamnet, Broadbottom—Improvements in shuttle tongues.
1784. Caleb Bedells, Leicester—An improvement in the manufacture of elastic fabrics.
1785. Samuel C. Lister, Bradford—Improvements in hackling, combing, and treating flax, wool, and other fibrous materials, before being spun.
1786. James A. Manning, Inner-temple—Improvements in the treatment of sewerage.
1787. John Henry Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture of india-rubber.—(Communication from Austin S. Day, of the United States of America.)
1788. George Nasmyth, Kennington, Surrey—Improvements in preserving animal and vegetable matters.
1789. William Jeremiah Murphy, Cork—Improvements in obtaining motive power.
1790. William M. Tileston, 16 Cannon-street—Improvements in machinery for ruling paper.—(Communication.)

Recorded August 8.

1791. William Hopkinson, Huddersfield—Improvements in steam-engine boilers, furnaces, and apparatus connected therewith.
1792. Benjamin W. Pycock, Southholme, Gainsborough, Lincolnshire—Improvement in curtain fixtures.—(Communication.)
1793. William Baron, Joseph Lang, and Henry Liversage, Blackburn—Improvements applicable to machinery for winding and for sizing or dressing yarns or threads.
1794. Nathaniel Smith, Thrapstone, Northamptonshire—An improved horse-rake.
1795. John Coope Haddan, Cannon-row—Improvements in the manufacture of rifled or other cannon.
1796. Robert B. Cooley, Nottingham—Improvements in the manufacture of hats.
1797. Phillipps A. Devy, 10 Old Jewry Chambers, Old Jewry—Improvements in hair fabrics.—(Communication.)

Recorded August 9.

1799. John Sidebottom, Broadbottom—Improvements in shuttles and in skewers for shuttles and other purposes.
1800. Victor Delperdange, Bruxelles, Belgium—Invention of a new mode of constructing and joining tubes and pipes.
1801. Edward Cooke, Balsall Heath, near Birmingham—An improvement or improvements in moulds used in casting certain parts of metallic furniture.
1802. Philippo Latour and Maurice Latour, Paris, and 32 Essex-street, Strand—Certain improvements in looms for weaving.
1804. Peter Armand le Compte de Fontaine Moreau, 4 South-street, Finsbury, and Paris—Improvements in feeding steam boilers.—(Communication.)
1805. George H. Bachoffner, Upper Montague-street—Improvements in appropriating certain public erections for advertising purposes.
1806. Thomas Sleight, 51 Mill-street, Hull—An improved compound for curing disorders of the bowels, cholera, diarrhœa, and dysentery.
1807. William B. Adams, 1 Adam-street, Adelphi—Improvements in locomotive engines and their trains.
1808. James Robertson, Patent Cask Works, Commercial-road—Improvements in the manufacture of casks and other wooden vessels, and in machinery or apparatus for those purposes.

Recorded August 10.

1809. Alfred Heaven, Longsight, near Manchester—Improvements in machinery for embroidering fabrics.
1810. William Mickle, Willington, Durham—Improvements in smelting or producing iron from ore in blast furnaces.
1811. William H. Lancaster and James Smith, Liverpool—Certain improvements in the manufacture of gas for illuminating, heating, and other purposes.
1812. George Durham, 3 Drummond-crescent, Euston-square, and Cornelius Wyatt, 1 Conduit-street, Regent-street—Improvements in the manufacture of grease for lubricating the axles of railway and other carriages, and the journals of machinery generally.
1813. Joseph Betteley, Liverpool—Improvements in the manufacture of ships' chain cables.
1814. Edward Finch, Chepstow—Improvements in machinery for discharging coals, minerals, and other materials from railway, tramway, and other waggons.
1815. Edward Finch, Chepstow—Improvements in machinery for loading and unloading coal and other vessels.
1816. Auguste Morin, Place de l'Hotel de Ville, 30 St. Etienne, département de la Loire, France—Improvements in the manufacture of artificial fuel.
1817. John L. Stevens, Fish-street-hill—Improvements in steam boilers.
1818. Philippe Latour and Maurice Latour, Paris, and 32 Essex-street, Strand—An improved machine to be used for cutting nails and driving them into the shoe.
1819. Pontus Lagergren, Stockholm, Sweden, and 32 Essex-Street, Strand—Improvements in paddle-wheels.
1820. George R. Innes, Valparaiso, Chili, at present residing in Birmingham—Improvements in raising and lowering rolling blinds.—(Communication.)
1821. Edwin Ullmer and William Ullmer, Fetter-lane—Improvements in machines for cutting paper, card, and millboards, and other like substances.

Recorded August 11.

1822. Paul L. P. Baragnon, 17 Rue Duvivier, Paris, and 4 South-street, Finsbury—Invention of a certain apparatus for preserving and reckoning coin.

1823. Thomas Hewitt, Lorn-street, Chester-road, Manchester—Improvement in machinery for pulverizing and levigating by means of pestle and mortar.

1824. Paul Pretsch, Islington—Improvements in the application of certain designs obtained on metallic surfaces by photographic and other agency.

1825. James Gardner, Plaistow—Improvements in the manufacture of salt.

1826. Charles E. Reeves, Edward-street, Portman-square—Improvements in the construction of repeating fire-arms.

1827. Walter Brown, 5 Catherine-street—Improvements in the manufacture of sheet metals, casks, and kegs.

1828. Lonis Turletti, 39 Rue de l'Echiquier, Paris, and 4 South-street, Finsbury—Invention of a portable alarm apparatus for the prevention of robbery by false keys, &c.

1829. Alexander C. Morrison, 2 Acacia-place—An improvement compound or mixture for feeding horses and other cattle.

1830. Edmund Topham, Mansfield-road, Nottingham—Invention of an apparatus for cleansing out the sediment from the water in steam boilers and preventing incrustation of the same.

Recorded August 13.

1831. Lonis Normandy, 67 Judd-street, Brunswick-square—A new circular weaving machine.—(Communication.)

1832. William J. Gregory, Leeds—Improvements in the construction of camp furniture.

1833. Walter Hancock, Upper Chadwell-street—Improvements in the manufacture of casks, or barrels, or of the linings of the same, and which improvements are also applicable to other hollow vessels.

1834. William Horsfield, Langley Mill, Derbyshire—Improvements in the construction of axle-boxes for railway carriages.

1835. Ebenezer D. Draper and George Draper, Massachusetts, U.S.—An improved vessel or can for oiling machinery.—(Communication.)

1836. Robert Blackburn, Wandsworth Paper Mills, Wandsworth, and William L. Duncan, Vale Cottage, Putney-vale—Improvements in bleaching,

1837. Thomas Butler, Willenhall, Staffordshire—Improvements in locks.

1838. Albert Thornton and Frederick Thornton, Nottingham—Improvements in the manufacture of elastic or knitted plush or piled fabrics for hats and other purposes.

Recorded August 14.

1839. Thomas Kempson, Birmingham—A new or improved steam engine and boiler.

1840. John Venables, Burslem, Staffordshire—Improvements in ornamenting articles made of clay and other similar plastic materials.

1841. Gilbert Sanders, Dublin, and Richard E. Donovan, Courtduffe, at Castleknock, Dublin—Improvements in maintaining the level of the water or other liquid in gas metres and steam boilers, and regulating or controlling the action of such apparatus.

1842. George Shears, East-place, Kennington-road—An improved construction of stereoscopes.

1843. Mark Mellor, Hyde—Certain improvements in self-acting mules.

1844. Lonis Marion, 29 Rue du Grand Prieuré, Paris—Invention of an apparatus for consuming smoke.

1845. John C. Haddan, Cannon-row—Improvements in the manufacture of cannon.

Recorded August 15.

1846. John Coghlan, Wexford—An improved method of pivoting artificial teeth

1847. Louis A. Pouget, Paris—Improvements in moderator lamps.

1848. Samuel Statham, Cloudesley-street, and Willoughby Smith, Hoxton—Improvements in electric telegraph cables or cores for the same.

1849. George Napier, Renfrew-street, Glasgow, and Adelphi, Middlesex—Constructing furnaces for marine and other boilers as well as for other furnaces, together with the apparatus employed therein for the purpose of heating the air previous to entering the furnace or furnaces, and for consuming the smoke and the saving of fuel.

1850. Alfred V. Newton, 66 Chancery-lane—Improved machinery for manufacturing railroad chairs.—(Communication.)

1851. John Avery, 32 Essex-street, Strand—An improved apparatus to be applied to drawers to secure them, and to give notice when any attempt is made to open the same by any improper person.—(Communication.)

1852. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in reins.—(Communication from Monsieur Sala.)

1853. John Barber, Manchester—Certain improvements in steam engines.

1854. Francis May, Tooley-street, Southwark—Improvements in obtaining instantaneous light.—(Communication.)

Recorded August 16.

1855. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and 39 Rue de l'Echiquier, Paris—Certain improvements in Jacquard machines.—(Communication.)

1856. Joachim H. Stocqueller, Regent-street, and William J. B. Saunders, Southwark—Improved mechanical means for obtaining elevations.

1857. Thomas Williams, Liverpool—Improvements in breech loading fire-arms, and in the method of loading the same.

1858. Charles Joyner, Birmingham—A new or improved tap or stopcock for liquids and gases.

1859. Andrew Shanks, 6 Robert-street, Adelphi, Westminster—Certain improvements in machines for cutting or shaping nuts.

1860. Frederick Paget, Vienna—An improved holder for steel or other pens by which ink is applied to them.—(Communication.)

1861. Charles Rowley, Birmingham—Improvements in elastic bands.

1862. John Atherton and William Boyea, Preston—Improvements in the looms for weaving.

1863. Samuel Monk, Bridge-street, Smethwick—Improvements in bricks for draining, sewering, and other purposes.

1864. William Fawcett and Francis B. Fawcett, Kidderminster—Improvements in the manufacture of carpets and similar fabrics, and in apparatus used therein.

1865. William Hudson, Burnley—Certain improvements in the construction of stop rods or protectors in power looms for weaving.

1866. William Maynes, Stockport—Certain improvements in self-acting temples to be used in weaving.

1867. William E. Baker, Cannon-street West—Improvements in sewing machines.—(Communication.)

Recorded August 17.

1868. Jean J. Dandnran, Paris, and 4 South-street, Finsbury—Improvements in driving apparatus.

1869. Joseph Fenton, Lancaster—Invention of a guard or apparatus to be used with moderator lamps.

1870. David Brown, Smethwick, and Jeremiah Brown, Kingswinford—New or improved machinery for the manufacture of bayonets.

1871. George Collier, Halifax—Improvements in weaving plush by power, parts of which improvements are applicable when weaving other fabrics.

1872. Thomas Edge, Great Peter-street—An improvement in the manufacture of gas metres, and other articles for containing and supplying gas.

Recorded August 18.

1873. Edward Heys, Great Jackson-street, Manchester—Improvements in flyers used in preparing and spinning cotton and other fibrous materials.

1874. William Sangster, 75 Cheapside—An improvement in the manufacture of umbrellas and parasols.

1875. Robert Crawford, Beith—Improvements in ornamental weaving by Jacquard looms.

1877. Alfred Savage, Eastcheap—Improvements in the means or mechanism for treating tea, sugar, coffee, chicory, and such substances as require the process of separation, reduction of size and mixing, or any one or two thereof.

1878. Ferdinand Tavernier, Paris—Improvements in apparatus employed in combing wool and other fibrous substances.

Recorded August 20.

1879. Alphonse René lo Mire de Normandy, Judd-street, Middlesex—Certain improvements in the manufacture of soap.

1880. André Dubrulle, Lille (Nord)—Improvements in safety lamps.

1881. Alexander Bain, Westbourne-park-road, Paddington—Invention of an instrument or apparatus for distributing liquids.

1882. Francis Journeaux, Dublin—Improvements in drying wheat and other grain.

1883. William Soelman, 3 Bennett-street, Fitzroy-square—Improvements in the construction of propellers.

1884. William Avery, Smethwick, near Birmingham—A new and improved method of joining or connecting straps or bands used for transmitting motive power.

1885. Henry Knighton, Stamford—An improved construction of portable drill.

1886. Pierre Gontier, Paris—Improvements in treating linseed, poppy, and other oils employed in the mixing of paint.

1887. John H. Brown, 4 Trafalgar-square, at present of Boulogne-sur-Mer, France—Improvements in the construction of ball cartridges for facilitating the loading and lubricating of fire-arms.

Recorded August 21.

1888. Robert Longsdon, Queen-street-place, New-cannon-street—Improvements in apparatus to be used for removing property into and out of strong rooms, and in the mode of securing such property from fire or theft.

1889. George Lewis, High Cross-street, Leicester—Invention of the making of taps and cocks of glass.

1891. John Cornes, Swan-lane—An improved method for consuming smoke.

1892. Carl L. A. Meinig, Piccadilly, and Franz X. Kukla, Raven-row, Mile-end—Improvements in ornamenting surfaces.

1893. James Orange, Nottingham—Improvements in apparatus for covering yarns or other cores.

1894. Lucins Paige, Vermont, U.S.—Certain new and useful improvements in brake mechanism for railway carriages.

1895. Edward Field, Drury-lane—Improvements in presses or machinery for embossing and colouring.

1896. Joseph Wormald and George Pollard, 2 Bridge-foot, Vauxhall—Improvements in ratchet braces.

Recorded August 22

1897. Dupont de Bussac, Brussels, and 32 Essex-street, Strand—The combination of hydriodic acid, watery or oily, or salts of iodine with tannic acid, the constituting parts of cinchona, or of sarsaparilla, or of the leaves of the walnut tree and iron, or with one or several of these bodies.

1898. Charles V. Bergh, Lacken, Belgium—An improvement in the mode of packing pistons of steam and other engines.

1899. Michel Blum, Ilzach, Ht. Rhin, France, and 32 Essex-street, Strand—An improved hood.

1900. William Spence, 50 Chancery Lane—Improvements in machinery for dressing and finishing cloth.—(Communication.)

1901. Jacob J. Lownds, New York—An improved extension pen and pencil case.

Recorded August 23.

1903. Jules T. A. Zinkernagel, Paris—Improvements in the manufacture of mosaic-work.

1904. Thomas E. Wyche, Camberwell—Improvements in propelling vessels.

1905. Wright Jones, Pendleton—Improvements in machinery or apparatus for printing woven fabrics and paper hangings.

1906. Charles Claus, Liverpool—Improvements in removing hairs from hides and skins.

1907. Victor Fouchier, 39 Rue de l'Echiquier, Paris, and 4 South-street, Finsbury—Improvements in constructing and preparing millstones.

1908. Ernest Parod, Paris, and 4 South-street, Finsbury—Certain improvements in the steering of steam and other vessels.

1909. Joseph G. Martien, Newark, New Jersey, U.S.—Improvements in preparing certain oxides of iron for use, and for apparatus to be used therein.

1910. William Denton, Addingham—Improvements in drawing wool and other fibrous substances off the combs of combing machines.

1912. William Kidman, Poplar—An improvement in tillars or yokes.

1913. Thomas Bartlett, Chambery, Savoy—Improvements in machinery for drilling or boring into stone.

Recorded August 24.

1914. Frederick S. Archer, Great Ruasell-street, Bloomsbury—Certain improvements in photography.

1915. William Wood, Monkhill, near Pontefract—Improvements in the manufacture of pile and other fabrics.

1916. Henry Frooms, Manchester—Improvements in the manufacture of pianofortes.

1917. William S. Gooding, Manchester—Invention of a tailor's clay cutter.

1918. Thomas de la Rue, Bunhill-row—An improvement in printing inks.

1919. Toussaint A. Radiguet, Lougjumeau, France—An improved dynamical apparatus for motive power.

1920. Peter Efferetz, Aix-la-Chapelle—Improvements in machinery for making bricks, tiles, pipes, and other similar articles.

1921. C. Schlickeysen, Berlin—Improvements in machinery for manufacturing pipes, bricks, and tiles.

Recorded August 25.

1922. John Avery, 32 Essex-street, Strand—Improvements in handles for augers, gimlets, and tools, and instruments to which such handles may be applicable.—(Communication.)

1923. John Avery, 32 Essex-street, Strand—Certain new and useful apparatus for exhausting and closing vessels.—(Communication.)

1924. John Avery, 32 Essex-street, Strand—Automatic attachments to be applied to gates and doors.—(Communication.)

1925. John Avery, 32 Essex-street, Strand—Improvements in sewing machines.—(Communication.)

1926. William Brown, Handsworth—Improvements in the manufacture of paper bags.

1927. Charles F. Stansbury, 67 Gracechurch-street—An improved mill for grinding.—(Communication.)

1929. Eugene Carless, Mile End, Middlesex—Improvements in the manufacture of artificial leather suitable for book binding and other purposes.
1930. Adam H. Hardy and Jacob H. Fordoff, North Bierley—Compound pill and ointment for the cure of scorbutic and similar disorders of the human body.

Recorded August 27.

1932. François Rualem, 29 Rue de Paris, à Belleville, France—Invention of a new process for manufacturing fuel for household and general purposes, called "the imperial coal."
1933. Celse E. Capron, South-street, Finsbury, and 39 Rue de l'Echiquier, Paris—An improved cupping apparatus.
1934. John W. Robson, 23 Grundy-street, Poplar New Town—Improvements in water closets.
1935. Thomas A. Cooling, Temple-chambers, Whitefriars—Improvements in pumps.
1936. Charles Humfrey, 14 Terrace, Camberwell—Improvements in the manufacture of fatty and oily acids.
1937. Emile C. F. Santelet, Paris—An improved impermeable cloth or fabric for sheltering, covering, and preserving in various purposes.
1938. James Smith, Bristol—Improvements in children's carriages or perambulators, and invalid carriages.
1939. Samuel Ludbrook, Mile End, Middlesex—Improvements in railway wheels.
1940. William Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for rolling or shaping metals.—(Communication from Jackson Brothers, Petin, Gaudet, & Company, Rive de Gier, France.)
1941. William Johnson, 47 Lincoln's-inn-Fields, and Glasgow—Improvements in railway breaks.—(Communication from Dominque Didier, Voiron, France.)
1942. Charles Humfrey, 14 Terrace, Camberwell—Invention of the application of certain products of fatty and oily matters to the manufacture of candles and other uses.
1943. Charles Esplin, 21 Windmill-street, Church-street, Lambeth—Improvements in apparatus for regulating the supply of gas.
1944. Alfred V. Newton, 66 Chancery-lane—Improvements in separating substances of different specific gravities.—(Communication.)
1945. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in percussion guns.—(Communication.)
1946. Benjamin Moore, New York, and 46 Regent-street, Middlesex—Improvements in sewing machines.—(Communication.)

Recorded August 28.

1947. Joseph Hopkinson, Jr., Huddersfield—Improvements in furnaces.
1948. Edward N. Fourdrinier, 22 Percy-circus, Pentonville—Improvements in machines for cleaning table knives.
1949. Richard Brooman, 166 Fleet-street—Improvements in umbrellas.—(Communication.)

Recorded August 29.

1950. James Booth, Manchester—Improvements in machinery for drilling and boring.
1952. Charles F. Stansbury, 67 Gracechurch-street—An improved seed planter.—(Communication.)
1954. Charles Radcliffe, Sowerby Bridge—Invention of a machine or apparatus for moistening or damping woollen or other textile fabrics for finishing.

Recorded August 30.

1955. James Moore, Glasgow—Improvements in marine and surveying compasses.
1956. John Gedge, 4 Wellington-street South, Strand—Improvements in galvanizing substances.—(Communication.)
1957. John Gedge, 4 Wellington-street South, Strand—Improvements in the manufacture of casks or barrels.—(Communication.)
1958. Charles F. Stansbury, 67 Gracechurch-street—An improved plane-iron.—(Communication.)
1959. Charles F. Stansbury, 67 Gracechurch-street—An improved changeable lock.—(Communication.)
1960. Charles F. Stansbury, 67 Gracechurch-street—Invention of a machine for splitting leather, and for analogous purposes.—(Communication.)
1961. John Juckes, 18 Baker-street, Lloyd-square, Islington—Improvements in furnaces.
1962. Henry C. Jennings, 8 Great Tower-street—An improved compound or medicine for cholera and diarrhœa.
1964. Paul E. Charton, Troyes Town, France—An improved metallic manometer.

Recorded August 31.

1965. William R. Palmer, New York—Improvements in writing-desks, which can be used in the dark, or after a person has retired for the night, or by the blind, or those with weak eyesight.
1966. Rudolph Schramm, 6 Warwick-crescent, Harrow-road, Paddington—Invention of a new process for treating cotton seed for the purpose of and previous to obtaining oil from it.—(Communication.)
1967. John Gedge, 4 Wellington-street South, Strand—Improvements in kilns, ovens, or furnaces.—(Communication.)
1968. George F. Rose, Ann-street, Birmingham—Certain improvements in lithographic and copper-plate printing presses.
1970. James White, East-street, Middlesex—Improved machinery for cutting soap into slabs, bars, and cakes.—(Communication.)

Recorded September 1.

1972. Robert W. Winfield and John Jackson, Birmingham—Improvements in metallic bedsteads and other articles of metallic furniture.
1974. Alfred M. Job, 22 Halliford-street, and Edwin Tomlinson, Barn's Cray, Crayford—A new article to be called "india-rubber leather cloth," applicable to covering roofs, floors, trunks, and for other similar purposes.
1976. Alexander I. Austen, Belmont, Vauxhall—An improvement in the manufacture of candles and night lights.
1978. Thomas Bentley, Margate, Kent—Improvements in apparatus for heating water or other fluids by gas.

Recorded September 3.

1984. Thomas J. Larmuth and John Smith, Salford—Improvements in machinery or apparatus for printing.
1986. Edward G. Juucs, Smethwick—An improvement in flattening cylinders of sheet glass.
1988. William H. Zahn, New York—Improvements in machinery for making covered or plaited twist and cord.
1990. Henry E. Flynn, Retreat, Ranelagh, Dublin—Invention of making signal communications between the guards and drivers of railway trains in transitu, and also in cases of accidents, making cautionary signals to trains approaching either from before or behind.
1992. William A. Gilbee, 4 South street, Finsbury—Improvements in the production of carburetted hydrogen gas.—(Communication.)
1994. George H. Golding, Maidstone, and Thomas Paine, Blackheath—Improvements in the manufacture of boots, shoes, clogs, and other like coverings for the feet.

Recorded September 4.

1995. William Woodcock and Thomas Blackburn, Over Darwen, and James Smalley, Blackburn—Improvements in the pistons of steam engines, which improvements are also applicable to pump buckets.
1998. William H. James, Camberwell—Improvements in steam engines.
2000. David G. Foster, Pentonville—Improved means of supporting or training plants.
2002. Warren De la Rue, Bunhill-row, Middlesex—Improvements in treating Burmese naphtha when obtaining products therefrom.
2004. Augustin Morel, Roulaix, France, and 4 South-street, Finsbury—Certain improvements in machinery for preparing fibrous materials to be combed or spun.
2006. James H. Bull, West-Farms, Westchester, New York, U.S.—Improvements in fountain inkstands.

Recorded September 5.

2008. William Craymer, Bristol—Improvements in propelling vessels.
2010. Agostino Palmiéri and Jean B. Ferrari, Paris, and 4 South-street, Finsbury—New system of construction of ships or vessels.—(Communication.)
2012. George Peacock, Gracechurch-street—Improvements in ship-building.
2014. Ichabod Nettleship, Derby—Improved spindle for the spinning of silk or other fibrous material.

Recorded September 6.

2016. Theodore Schwartz, New York, U.S., now of 67 Gracechurch-street—An improvement in heating or cooling aeriform and liquid bodies.
2020. William A. Gilbee, 4 South-street—An improved process and apparatus for the purification and clarification of oils.—(Communication.)

Recorded September 7.

2022. Selby Hand, Glinton Iron Works, Glinton—An improved combined cake-crushing, oat-bruising, and bean-splitting mill.
2024. Richard A. Brooman, 166 Fleet-street—An improvement in casting mortars, cannon, and other hollow articles.—(Communication.)
2026. John Stewart, Preston—Improvements in the construction of steam boilers for the more effectual consumption of smoke.
2028. Louis Dameron, Paris, and 4 South-street, Finsbury—Improvements in the construction of carriages.

Recorded September 8.

2030. Henry Hart, Dover—Certain improvements in the manufacture and composition of lubricating and burning oils.—(Communication.)
2034. Henri Boucherie, Bordeaux—Certain improvements in machinery for impregnating woods with chemical materials for their preservation and colouration.
2036. Anguish H. A. Durant, Tong Castle, Salop—Improvements in apparatus for raising and lowering weights, and for saving persons and property from fire.
2038 Anguish H. A. Durant, Tong Castle, Salop—Improvements in apparatus for ascertaining the number of, and distance travelled by, passengers in public carriages.
2040. Anguish H. A. Durant, Tong Castle, Salop—Improvements in apparatus for sweeping and cleaning chimneys.
2042. Henry Webster, Dalby-terrace, City-road—An improvement in the construction of chronometers, clocks, watches, and other time-pieces.
2044. Jean Pauet, Echenoz-la-meline, near Vesoul, France—An improved hydraulic system for propelling on railways, or obtaining motive power and distributing water.

Recorded September 10.

2046. Charles Hewett, 8 King's-road, Pentonville—Certain improvements in baking-ovens.
2042. John Rhodes and John Johnson, Manchester—Certain improvements in steam engines, part of which is applicable to pumps.

Recorded September 11

2052. Josiah Gimson, Welford-road, Leicester—An improved feed apparatus for steam boilers.
2054. George S. Hinchliff, Piccadilly—Improvements in the manufacture of paper-hangings.—(Communication.)
2056. François H. Lebaigue, Little Titchfield-street—An improvement in the manufacture of chocolate.

Recorded September 12.

2060. James Higgin, Manchester—Improvements in treating madder, or preparations of madder, so as to obtain a colouring substance therefrom.
2064. John G. Roger, Trinity-street, Cardiff—Improvements in ships' signal lanterns.

Recorded September 13.

2068. Robert B. Cousens, 50 Halliford-street, Islington—Improvements in machinery or apparatus for making casks.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

TO READERS AND CORRESPONDENTS.

J. P. Shawbury.—First multiply all the driving wheels together, counting the number of teeth in each; then all the driven wheels. Divide the product of the former by that of the latter, and the result will give the speed relations. We are obliged for his good opinion, which is creditable to his understanding.

P. H., Cork, and Ignoramus, Southampton, are at a loss to understand Mr. Jones' multiplying gear, described at page 114 of our August Part. They may perhaps succeed, if they first consider what would be the effect of driving the arrangement from the end opposite to that intended. If the shaft, E, is driven, it will require to make six turns to produce one turn of the shaft, A. In the first turn, the 30 teeth of the pinion engage with 30 of the 35 teeth of the fixed wheel, the starting tooth of the pinion being 5 teeth short of the point it started from. The pinion has, therefore, turned on its axis to the extent of 5 teeth, or a sixth of a turn, in the opposite direction to the rotation of the shaft, E, and it will require five more turns of the latter to complete a turn of the pinion. It is therefore obvious, that if the shaft, A, is the driver, it will cause the shaft, E, to make six times as many turns as it does itself.

R. N., Douglas, Isle of Man.—We do not think the hydraulic ram will answer his purpose. This apparatus is used to raise a small quantity of water to a considerable height, with a very large expenditure of water which has a comparatively low fall.

A. S., Norwich.—When it is necessary to find the side of a square equal in area to a given circle, it is certainly the best plan to multiply the diameter by ·8862, instead of first finding the circumference and then deducing it from that; but it has been in use as long as the multiplier for obtaining the circumference.

Tyro.—We cannot publish old letters.

Boiler.—This is evidently a small pamphlet, now, doubtless, out of print.

THE GREAT EXHIBITION AT PARIS, 1855.

FROM OUR OWN CORRESPONDENT.

III.

Whilst the main Exhibition building and the Panorama afford a rich and unsurpassable feast to the eye, it is in the Annexe that the thinking mind will find the greatest attractions—the most significant and important subjects for its study. The Annexe possesses an interest all its own; but, at the same time, a contemplation of its varied contents cannot but add new interest to the other portions of the Exhibition. There we see results—pleasing or not to the superficial observer—but here we get an insight into some of the means by which those results are obtained, and our estimation of each rises or falls according to the difficulty surmounted, or the talent displayed in its production, as made manifest to us in this workshop to the great show-room.

There is the same fault as regards classification and arrangement in the Annexe that prevails over the rest of the Exhibition, though not to quite so bewildering an extent. The eastern half of the gallery is, for the most part, occupied by raw products, and prepared and unprepared substances and materials used in the arts and manufactures. The floor space of the western half of the building is exclusively devoted to machinery—machines in motion occupying about one-half of this section. The wall space is generally devoted to carpets, rugs, matting, oilcloths, leather, paper-hangings, and similar articles. The English spaces are arranged in the best and most complete manner, and the Prussian spaces are the next best in this respect.

In particularising the objects of chief importance and interest in the Annexe, we shall commence with the eastern end, proceeding regularly through the collection, which course will prevent our omitting anything worthy of note, though we may have to treat of similar things separately, and at different points of our progress.

The extreme eastern end of the Annexe is occupied by a heterogeneous collection from England. The first noticeable object is a piece of Mr. Scott Russell's monster ship, showing the cellular construction of the sides, adopted to give strength, and arranged on the same principles for that purpose as the top and bottom of the Menai tube. A series of photographic views, showing the actual ship as in process of construction at Millwall, are also exhibited, as well as one of the cranks of the engines by which the ship is to be propelled. In the centre, opposite to the entrance, is a set of cast-iron articles exhibited by the Coalbrookdale Company, such as bronzed garden chairs, flower stands, and fire-grates. Next follow, along the centre, a collection of samples of manufactured iron in the shape of bars, sheet, and rails. Amongst the latter are some of extraordinary length—namely, a bridge-rail from Taiback, South Wales, measuring 80 feet in length; a common I-rail from the Derwent Company, Gateshead, 75 feet; and another I-rail from Tredegar, South Wales, reaching 85 feet. In appropriate proximity to the show of iron is a stand upwards of 80 feet long, carrying specimens of coal from the fields of Scotland, Wales, Yorkshire, Shropshire, and Staffordshire. The chief portions of the collections of iron and coal have been arranged by Messrs. Bord, Blackwell, and Robinson, as commissioned by the Board of Trade, and whilst specimens are shown from every place and establishment of any note, the whole are disposed in a most excellent manner, so that there is not in the entire Exhibition another space of similar dimensions representing so much that is valuable, or of so extensive a significance and importance. With regard to the samples of iron, there is no attempt at show, each specimen being exactly what its exhibitor offers in the way of ordinary trade. In the Continental collections there are, on the contrary, everywhere evidences of special effort for the occasion, and, unless prices and other particulars are inquired into, a very erroneous comparative opinion of the manufactures of each country will be obtained. Amongst the metallic collections is one by the well-known firm of Johnson & Matthey of London, of metallic products arising in the refining of precious metals. Near these, Picciotto of London shows some extremely beautiful ultramarine blue; and Morson and Sons of London have a very complete case of chemicals. Proceeding onwards, we observe some immense masses of soap, suggesting the query as to its being obtained by quarrying, like granite; and a splendid case advertising Price's candles. Bennett of Cheapside advertises by means of a large clock mounted upon a barbarously gorgeous framework; near which are several cases of perfumery, preserves, pickles, and Rowney's cases of colours, and artists' materials, all apparently very excellent. We next pass through collections of horse furniture, flanked by samples of varnished leathers and oilcloths, to a small collection of agricultural apparatus. Here we notice Clayton's brick machine, Shanks' Arbroath mowing machine, a pretty model of a horse-power apparatus and thrashing machine by Garrett & Co. of Saxmundham, and Ransome & Sims' agricultural engine on wheels, comprehending the now common arrangement of a horizontal cylinder mounted on the top of the boiler. Barrett & Co. of Reading show a fixed engine and a few agricultural machines. Hornsby & Son of Grantham exhibit several things which seem to have met with particular favour, as they are almost all marked sold, the Emperor himself having bought a thrashing machine of the kind which obtained a prize at the recent Carlisle show. An agricultural engine by the same firm has the cylinder encased in the top of the fire-box, and is also sold. Crosskill of Beverley is represented by a clodcrusher, consisting of a series of serrated discs or rollers, a cart, cart wheels and axles, a Bell's reaper, a root washing machine, and a Norwegian harrow. Clayton, Shuttleworth, & Co. of Lincoln have a combined thrashing, winnowing, and sacking apparatus, fixed and portable steam engines, and a grinding mill. A fixed engine by W. Dray & Co. of London is marked as sold, and they have also a Hussey's reaper and a cheese press. Howard of Bedford has also been fortunate in sales. He exhibits ploughs, horse rakes, and his patent screwed-beam harrows. A large collection of agricultural implements and machines are arrayed in the grounds outside the Panorama buildings, and in one or two detached erections. The French and other Continental examples have generally a very clumsy appearance; but their variety is so great, and they are many of them of such extraordinary shapes, that it would be quite impossible to particularise them within the limits of the present article. The more important implements from all countries were tried in the open field, at Trappes, near Paris, but the results are not as yet made public authentically. Of twenty-four ploughs that were tried, those of Howard of Bedford, and of Grignon of France, seemed to find most favour. Morin's and Bentall's dynamometers were used for indicating the draught of the ploughs. Of several harrows, one by Cappelen of Norway was most liked. Several thrashing machines were tried, and one by Pitts, of the United States, thrashed 740 litres during the time that 410 were thrashed by Clayton's machine, 250 by Duvoir's, much used in the Paris district, 150 by Piuet's, and 60 by six men.

To return to the Annexe. The space of the eastern half is considerably increased by galleries along each side, wherein the exhibited articles are from the countries to which the floor spaces immediately below them are devoted. This arrangement produces a great many subdivisions of the space; and as the staircases giving access to the galleries are few and far between, any one wishing to study the collections of each country by itself, must lose half his time in searching for the staircases, and in running up and down. The only excuse for this defect seems to be, that it permits the marking out of each country's space by national flags waving over both gallery and floor space. In the English gallery space corresponding to the portion we have so far noticed, there is very little worthy of remark. Amongst these are some very cheap paper-hangings, dried plants, curiosities, raw products, and woods from New Zealand, Norfolk Island, Van Diemen's Land, and Ceylon. These are on the north side, whilst on the south side are similar collections from other

English colonies—Guiana, Jamaica, Mauritius, Bahamas, Malta, and the rest. Near the agricultural implements below, are extensive collections of cereals and vegetables, stuffed heads of various breeds of oxen, drawings of various breeds of sheep, fruits and roots represented in wax, and other odds and ends appertaining to agriculture.

At the inner end of this patch of English space, and on the floor of the building, is a small compartment appropriated to Canada. Though so small, this space contains a collection representing very completely a very extensive range of industrial pursuits. The Canadians, feeling that they had derived immense benefits by coming forward in our Exhibition of 1851, have been encouraged to make a more extensive and complete display on the present occasion. The collection has been arranged and selected by the colonial government, the transport and other expenses being defrayed out of the revenue. The principal object in the space is a magnificent trophy of timber, in which excellent specimens of all the most useful trees find a place; such as oak, yellow pine, black walnut, maple, beech, birch, cherry-tree, and hickory. Amongst the specimens of wood are examples of articles manufactured from it, such as doors and window-frames, all turned out by machinery, and offered at extremely low prices. Doors, with their framing, are ticketed at 16s. each; mouldings, 8 inches wide and 100 feet long, at the same price; first-rate wheel-spokes, at 5d. each; excellently-shaped handles for axes, of unexceptionable material, at 6d. each; oak flooring, ready made, at 20s. for 10 square feet. The timber trophy is ornamented with skins and furs, and with various implements, brooms, spades, and such like. A new marine product is shown in this space, namely, isinglass obtained from the sturgeon, the manufacture of it having originated from a hint thrown out by Professor Owen some time ago. There are some interesting models of bridges and other engineering and architectural works executed in Canada;—one of the tubular bridge *Victoria*, over the St. Lawrence at Montreal, 6138 feet long; a model of the lock system of the St. Lawrence; another of a wooden bridge, 150 feet span, and costing only £600; and a beautiful granite model of the Brock monument. The colonists show excellent tools, agricultural implements, harness, and carriages, amongst the latter of which is an elegant hickory-built one, purchased by Prince Napoleon. There are two or three fire-engines, for excellence in which apparatus the Canadians are celebrated, and one of these is said to have proved itself the best at a recent trial, in competition with some French engines. One of the fire-engines from Quebec, however, is very clumsy and unmechanical in construction, having, amongst other peculiarities, segmental levers and chains for working the pumps. The Canadian display of agricultural produce is very good, and praise is due for the way in which the samples are exhibited; namely, in large quantities, put up in neat barrels, with glass panels fitted into their heads, thus giving a far better idea of the article than the mere handful that is usually shown. This collection also includes manufactured cereals, in the form of flour, and some biscuits, which last have gained the admiration of every one who has seen them, being of a beautiful colour, and perfectly fresh and sweet to the taste, although upwards of five months old. We understand that some of these biscuits had actually been sold for retail sale in Paris. The geological character of the colony is not without its representative, in the form of a collection of ores and minerals, excellently arranged by Mr. Logan, the Canadian Commissioner, who himself surveyed the structure of the colonial soil. In this collection are slates and marbles, masses of phosphate of lime, imbedded in calcareous rock; mica, whetstones, and sandstones, of sufficient purity for the glass manufacture; copper ores; magnetic iron ore, yielding 65 per cent. of metal; and some few gold nuggets.

Leaving the Canadian space, we pass on to a small detached portion of the French space, containing the contributions of the Minister of Commerce, consisting of some models of public works, bridges, viaducts, lighthouses, and canal and river works. Near these is an excellent working model of the engines of the *Algésiras*, a 92-gun ship, constructed at Toulon. They are similar to those of the *Danube*, already described by us. This model is on a larger scale than that of the *Danube*, and we notice one or two additional peculiarities. The crank pins are fixed into weighted discs, according to Bourne's system, and the engines are reversed, by means of a movement similar to one in use in some kinds of textile machinery. As mentioned in our previous allusion to these engines, the valves are worked by means of a separate shaft, driven from the main shaft by spur gearing. An internal wheel-and-pinion movement, combined with a friction wheel, is fitted upon the secondary shaft, which by its means can be set round as regards the main shaft, so as to alter the relation of the motions of the valves to those of the steam pistons. To judge from some beautiful models exhibited here, the French still maintain their superiority in designing the forms of ships. One extremely beautiful one of a screw steamer is by Nillus of Havre, and there are others far before any exhibited from England, not even excepting Mr. Scott Russell's. The working out of the "wave theory" certainly does not please the eye, and we must confess to a preference for the teaching of the eye, to that of the illogical conclusions upon which that theory is built. Amongst the models is one of the engine-room of the *Napoleon*, of 90 guns, constructed of one-tenth the actual size, the engines being of wood. Another model is of Accarier's turbine propeller, thought a novel and important invention by the French, but in reality nothing but a modification of Bodmer's and Ruthven's unsuccessful schemes.

In this space are also exhibited models of two very ingenious contrivances by David of Havre. One of these is a tiller apparatus, which we engrave amongst the Monthly Notes of the present part of our Journal. The other contrivance is applied to a capstan, to prevent the surging and slipping of the rope when being coiled upon it, and consists simply of a loose ring and a small pulley. The pulley is carried in a small box, which can be set in any one of a series of small sockets formed round the capstan, upon the fixed base flange. The rope is entered upon the capstan barrel from below, the loose end being paid off above in the usual way. The small pulley is placed in a socket directly opposite to the point where the rope first touches the barrel, and the loose ring rests and runs round upon it with the capstan. The ring is slightly tilted by the pulley, and forms an inclined plane from the point where the rope enters upon the barrel to the opposite side; and this has the effect of gradually shifting the coil of rope upwards as it is wound upon the barrel.

In the gallery portion of the space we have just been going over, there is nothing deserving particular mention.

We pass on, through a series of small spaces appropriated to Tuscany, Sardinia, Switzerland, Spain, Portugal, Egypt, Turkey, Greece, the Netherlands, Norway, Sweden, and Denmark. We notice here some electro-telegraphic apparatus from Tuscany; also a foot-lathe and a small horizontal engine by Ed. Barnes, of the Maria-Antonia Railway, and models of Minotto's V-groove pulley gearing, which we should certainly consider a backward step in mechanics. Geneva shows here some pretty engine-turning lathes, and there are some neat white-and-gilt stoves from Helvetia. There is also a model of a new reversing apparatus for locomotives, but so complicated in appearance that we could not spare time to make out its principle. Near the last are a model and drawings of a floating undershot water-wheel, designed for a stream varying very much in height. The gearing is contrived so as to let the wheel rise and fall with the water, the floats remaining immersed to a constant depth. The other small spaces hereabouts, for the most part contain collections of the raw produce of the several countries and their dependencies; and in the Netherlands space, is a very fine trophy of the productions of Java and her other colonies. In the Swedish space are some figures, exhibiting the peculiar costumes of the country; specimens of metals and ores; kitchen stoves; chain cables; sledges; a set of models of water-wheels, rolling-mills, a tilt-hammer, a cupola, and other things connected with the iron manufacture; and a fire-engine. From Denmark there are one or two agricultural machines and some tools. Passing into a space devoted to the States of the Zollverein, which comes next in our westward course, we observe some chemical apparatus from Bavaria, with curious automatic contrivances for mixing the substances under treatment. There is also some chemical apparatus from Würtemberg, and from this last place there is a large trophy covered with scythes. From Hesse there is a brick machine, having a square piston, working horizontally, and forcing the clay through dies in the ordinary manner. A very extensive series of Prussian minerals is shown here. Here too is Krupp's splendid show of cast-steel in every variety of form. The chief article of the collection is a piece of solid cast-steel, weighing 11,030 lbs., evidently produced for the occasion. This collection has attracted a great deal of attention, and shows a very advanced state in this special manufacture. Krupp, who has an immense establishment, and who produces a great variety of articles, also shows here three immense sugar evaporators, conspicuously mounted on a large stage, and glittering with all the glories of polished copper and brass. At the four corners of the staging bearing Krupp's evaporators are some pretty hollow metal pillars, painted in imitation of marble and granite, by Varges of Berlin. Passing on we notice a collection of Westphalian minerals, an assortment of Prussian leather, a small trophy of iron in various shapes for manufacturing purposes, and bearing some specimens of extremely thin sheet-iron of excellent quality from the works of Count Renard, Silesia, models of the machinery of the Hartz mines, samples of excellent steel, manufactured by Gouvy & Co. of Rhenish Prussia, specimens of coal, and samples of iron and steel from the Phœnix Company of Prussia. The Vielle Montagne Zinc Company seems determined to force its existence on the public, placing collections of its productions all over the Exhibition, wherever the slightest excuse can be found for so doing. Thus, it is not content to exhibit in the space belonging to the country whence it obtains its zinc, and where its chief manufactories are, but it has collections as from the several countries where it has established agencies and branch works. In the Prussian space, through which we are now passing, this Company chiefly exhibits its zinc ores. Near these are some more samples of sheet-plate and bar-iron, whilst at one side are three large bells of cast-steel from Bochum, the largest weighing 4300 lbs., and also two large masses of cast-steel from the same place. At the sides here and under the galleries, are various raw products, iron-mongers' ware, kitchen ranges, gas cooking stoves, wax candles, and copper and other ores. Further on, in the centre of the floor, is a turret clock from Bavaria, mounted upon a very ugly prominent erection, but possessing a remarkably simple escapement movement. Here also are some cast-iron pipes of various size, but of very rough and inferior workmanship.

The gallery portion of this section of Prussian space contains, on one side, two or three varieties of electro-telegraphic apparatus, which mark down the messages by perforations upon long strips of paper; some well-made mathematical and scientific instruments, and some geometric drawing models in glass—a good material for the purpose; paper-hangings on the walls; cases of paper and card-board of various qualities, some very good; some specimens of the applications of india-rubber, and a model of a roof supported by tension rods. In the opposite gallery are some samples of beet-root sugar from Würtemberg, some sewing silk of an extremely beautiful carmine colour, and collections of chemicals and minerals.

We next enter a section of Austrian space, the most striking object in which is a trophy of Austrian wines, consisting of an immense number of bottles all full to the cork, and labelled and arranged in a frame shaped to the outline of a monster bottle, towering to the roof of the building. In this space are two sets of models of agricultural implements, evidently perfect miniatures of their full-sized originals. There are also some well-arranged collections of cereals, woods, and other raw products. A little farther on is a pyramidal trophy of wax and composition candles, remarkable for their pure white colour. Near the candles are some pictures made up of Congreve matches, the effect being rendered by the mosaic-like arrangement of the different colours of the composition with which the matches are tipped. The subject of one picture is Mount Vesuvius, appropriately signifying the volcanic disturbance which could be made to arise in the material of the picture. If these matches are not "dummies," the authorities are to blame for allowing their introduction into the building, as any accidental touch might give a fearful start to a conflagration. It is near here that the Emperor's bust in white soap is placed. Austria is not without a few specimens of its iron manufactures, amongst which are some railway-wheel tyres, and a cast-iron street lamp of elegant design. There is also a collection of ores. Up stairs, the Austrians show, on one side, some models of bridges, ships—one of these in the act of being launched from its slip—maps, mathematical instruments, scientific apparatus, and geometric models, and some specimens of wire rope. There is also a collection of common cutlery, scythes, sickles, and gardening knives, and some watch springs, and other small steel articles. On the opposite side are various odds and ends, but nothing worthy of note, except perhaps some samples of apparently very excellent loaf sugar.

A Belgium compartment next claims our attention, and we notice in it some beautiful grates and chimney-pieces, and some well-made but clumsily-contrived horse furniture, also specimens of the Belgian iron manufactures. Up stairs there are—a beautiful perspective subject, painted on three planes at right angles to each other, some electro-telegraphic apparatus, and a curious compensating clock pendulum, consisting of a steel "lazy-tongs," with transverse ties of brass, the contraction of the brass lengthening the joints to make up for the contraction of the steel. Here are also various Belgian raw and manufactured products, cereals, furs, paper, oilcloths, some inlaid wood, a wretchedly poor model of a farm, but probably made by some untaught mechanical genius, a collection of razor stones, and a case containing balances for minute quantities, and one or two electric clocks by Gerard, of Liege.

In the Annexe, as in every other part of the Exhibition, France, of course, assumes the place of honour, and appropriates to herself the best space. Here she occupies one-half of the building, taking the central portion, and placing her machinery on the western side of the centre, and her raw and partially manufactured products on the eastern side; whilst other countries have had to divide their space, placing their machinery to the west, and their raw product to the east of the French space.

Having gone over the several sections to the east of the French space, we now enter this last. Here we first observe the articles exhibited by the more important of the Parisian clockmakers, the minor clock and watchmakers having their cases arranged along the gallery crossing the Cours la Reine, and by which the Annexe communicates with the other Exhibition buildings. There is a fine turret clock by Wagner, whom we have already mentioned as having found space in the nave of the main building. The opticians and mathematical and philosophical instrument-makers have here a goodly range of cases, containing some interesting things, such as, an electro-telegraphic apparatus which jots down messages with a pencil in a peculiar written language of its own, and an instrument, or rather machine, for measuring the velocity of light and electricity. Clair, of Paris, shows various dynamometers and indicators, a model of a turbine, and a pendulous miniature cannon for trying the force of gunpowder. Hempel, of Paris, has a curious automatic apparatus for weighing and distributing coins according to their weight, a model of a locomotive, and scientific apparatus. In proceeding along the centre of the building, we are very apt to forget the dark corners under the side galleries; but if these contain few things of an ornamental nature, there are still to be found many useful articles. Thus, near the opticians' cases, we find at the sides some good examples of stoves, kitchen utensils, and various other metal goods. We also observe a well-executed model of a bleach-works, an apparatus for converting salt water into fresh, a splendid cooking range by Baudon, of Paris. Towards the centre, again, is Rolland's bread-baking apparatus, constructed upon a new system, which appears to have come into very general use in France, as shown by maps which the inventor exhibits, his agencies being indicated by pins with bright-coloured heads, stuck into the map at the several towns—a novel idea. There is nothing very peculiar in the system, which merely comprehends a thorough working up of the materials by machinery, and an economical application of heat in a gradual manner. Hereabouts there is an accumulation of stoves and culinary apparatus, and further on we notice a bleaching apparatus. A model of the Audincourt forges next catches our eye, and with it a model of a direct-acting horizontal steam-hammer, which may be a convenient and useful modification for some varieties of light work. After these come samples of iron and copper pipes, columns of various kinds of marble, bronzed cast-iron articles from Lyons, specimens of work from the Vulcan forges of Paris, some very well-made and highly ornamented foot lathes, evidently for amateurs, and a common foot lathe, undoubtedly copied from Whitworth's excellent pattern. For some time back we have been travelling along a flat country with an occasional lofty erection, but here we seem to be passing through a long deep cutting—the exhibited articles towering over our heads on both sides of us, and from their nature reminding us of the bowels of the earth whence they have been dug. Here we find palpable data for learning the extent and characteristics of the French iron manufacture. Iron is here in all the forms in which it is handed over by its original producer, to the more advanced manufacturers, who put it to its ultimate use in the construction of machinery, in shipbuilding, and in whatever it can be made serviceable to man. A very fine collection is exhibited from Cavé's forge, foundry, and engine works—one of the largest establishments in Paris; this collection comprehending wrought-iron shafts of large size, a wooden full-sized model or pattern of a still larger shaft, and railway wheels and tyres. Near these are—an immense cast-iron pan, some 15 feet in diameter, from Eure; some large bells from Metz, Gallois, and Lyons; a row of iron safes at the side; Martin's iron gun-carriage, of an improved form, for fortresses, and recently adopted by the French government; collections of files, scythes, carriage springs, and specimens of sheet copper and brass from Rouen. Further on is a pair of well-finished 7 feet locomotive wheels from Bitschwitter, Haut Rhin, and near these are the products of the Montataire forges, iron plates and rails. Here is a model of a bird's-wing propelling system, which would doubtless please Mr. Ewbank, but which is arrogantly termed *propulseur de Dieu*. We next come to the forgings exhibited by Petin, Gaudet, & Co., of Paris, amongst which is a model of an immense piece, a shaft with six double cranks, constructed for engines on Cavé's system, already described by us.* This Company also show a railway wheel tyre, which is upwards of 12 feet in diameter, and a steam boiler constructed of cast-steel plates. The next object is a model, on an unusually large scale, of the Anzin coal mine, very faithfully executed, and very instructive as regards the various modes of working. The lowering and raising apparatus is shown, and is provided with safety gear, which is somewhat complicated in appearance. The model is accompanied by safety lamps, mining implements of all kinds, photographs and plans of the works above ground, and everything that can add interest to the collection. Near the last are specimens of the rails from the central railway of France, and various products from the forges of St. Maur and Chamouilley.

This brings us to the Colonial department; but, before entering it, we must mention what is worth seeing in the gallery space corresponding to the floor space we have just taken our readers through. It is almost impossible to conceive the bewildering mixture of things to be found in these galleries. Here the French bandage and artificial limb-makers have their cases, an extensive range. These are to the front, as are also several cases of surgical instruments, whilst behind and near the wall are a series of curiosities—mechanical drawing models, geographical models, relief surface globes, astronomical models, a beautiful orrery by Grosselin & Co., a celestial globe, made of glass, with the stars affixed externally, and a set of beautiful lecturer's diagrams relating to optics, pneumatics, physics, phenomena of steam, and similar subjects, by M. Victor Regnault. Amongst various kinds of apparatus for use in teaching reading, writing, and arithmetic, is shown one very ingenious mode of teaching writing by M. Sinet, a retired officer of the old Imperial Guard. M. Sinet starts with the idea, that the art of writing well is to be attained by practice; that, if the hand can be forced to trace accurately a series of forms a sufficient number of times, it will at length acquire the power of repeating these forms with facility, and without requiring the attention necessary at first. To give this forced practice, a series of metal plates are prepared, with writing engraved upon them in deeply indented lines, and the pupil is made to carry a pen along these lines, which are contrived so that the hand unconsciously acts on the pen in the manner which would produce fine up-strokes and thick down-strokes, where wanted, if writing in the common way. The pupil is thus at the very outset constrained to give the best possible forms to his letters, and a little practice enables him to make these forms as easily as others. This system has the fault of not showing the work performed, and one instructor will be able to attend to but few pupils, as he must watch them narrowly, to make sure that the prescribed practice is actually gone through. Returning again to the front of the gallery, we examine the assortments exhibited by the Paris paper-makers, and notice also some very excellent papers from Angoulême. We find up here also some more opticians' cases, containing microscopes, mathematical and drawing instruments, quadrants, sextants, and other nautical instruments, photographic apparatus, stereoscopes, lenses, spectacle and telescope glasses, and some fine steel measuring tapes. In the opposite gallery are a long range of cases, containing chemicals, soaps, perfumery, candles, sugar, groceries, drugs, confectionary, coloured gelatine, oil colours, varnishes, crayons, and india-rubber articles.

We now come to the splendid collection of raw produce from the French colonies, chiefly Algeria, exhibited and arranged by the French Minister of War. The most striking object in this collection is a towering trophy of grasses, maize, and bamboo canes. An astonishing variety of fruits are shown, indicating a very great range of climate. Amongst oranges, citrons, lemons, dates, bananas, there are almonds, figs, sweet acorns, pomegranates, olives, grapes, and apples; also, maize, rice, millet, wheat, oats, barley, rye, yams, and potatoes; and of fibrous materials, cotton, hemp, and flax. There is lead ore, containing a large per centage of silver; and the beautiful Algerian agate, said to have been found in quarries worked by the Romans. There are chairs covered and stuffed with *crin d'Afrique*, a very fine kind of piassava resembling horse-hair, and obtained from the dwarf palm. But perhaps the most interesting objects in this collection are the African woods, which are remarkable for their variety, beauty, and excellence. Amongst these woods are—that of the almond tree, the arbutus, whitethorn, alder, enia arborea, carob tree, and cedar. Sections are exhibited of a trunk of cedar measuring 16 feet in diameter at the base, and there is a splendid circular table, made of a single piece, 4½ feet in diameter. Besides the woods named, there are exhibited specimens of citron wood, a kind of ash, pencil cedar, holly of large size and beautiful colour, white mulberry, close-grained myrtle, walnut, olive, and Thuja wood. Not only are mere specimens of these woods shown, but their capabilities are developed in the construction of various articles of furniture and pianos. The beautiful Thuja wood seems to be one of the best, and most in request. This wood is remarkable for its beautifully variegated hues, and for the fine polish it takes, looking, when brushed up, like finely and regularly veined marble. One of the specimens of furniture in Algerian wood, is a horse-shoe table by Guyot, of Paris, measuring three yards across, with a central space a yard wide. This table is very ingeniously, and at the same time simply contrived, to close into a circular table, one yard in diameter. Amongst the other articles in the Algerian collection, are vegetable oils for burning and lubrication, vegetable honey and soap, various medicinal plants, gums, and raisins; Arabian mats and carpets, and Algeria grown silk. Lastly, there is a large collection of ores from Algeria, Senegal, and other colonies, and near these a beautifully-executed picture of the surface works of the Ténès copper mines.

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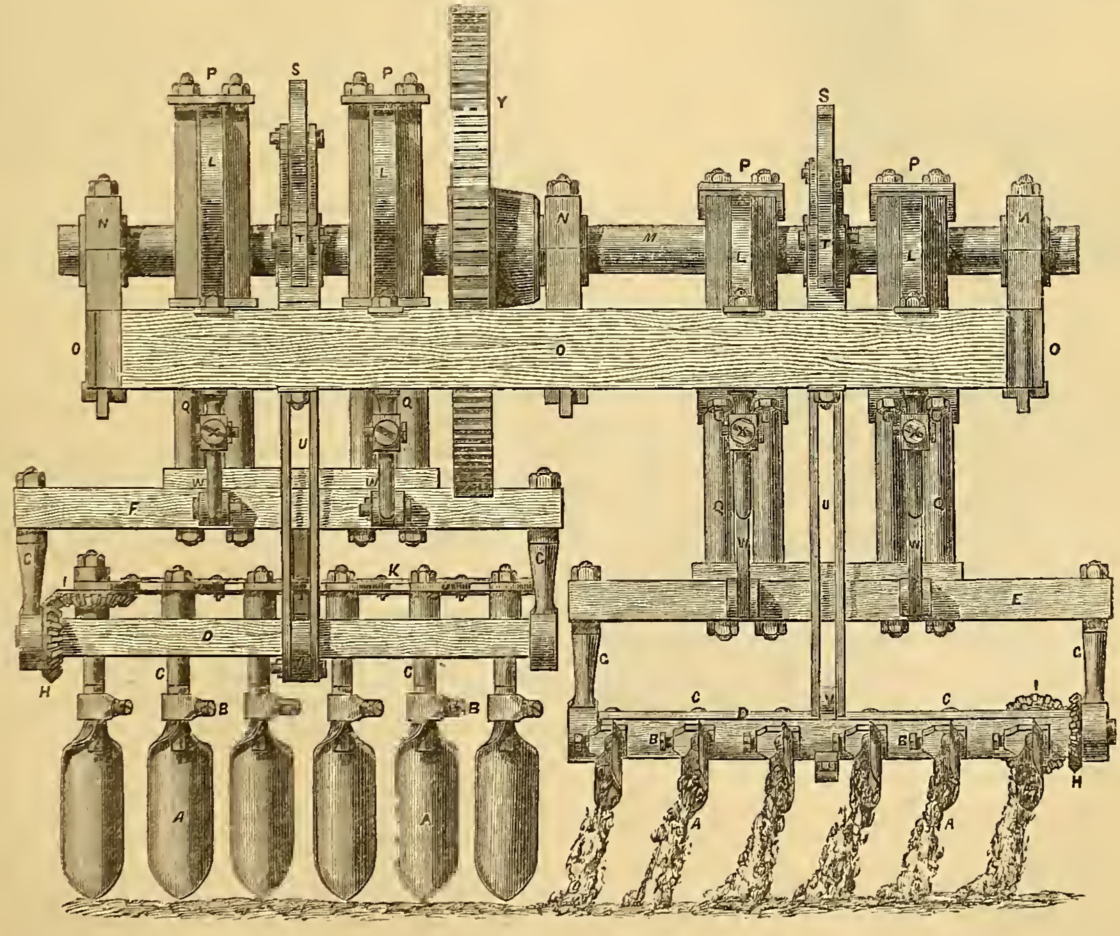
* Page 257, Vol. VI.

This brings us to the open space at the centre of the Annexe, and here we rest, admiring the beautiful central fountain, consisting of aquatic flowers made of zinc, and painted. Innumerable tiny jets of water issue from the points of the leaves and stems, and the whole has a most refreshing effect. The fountain is designed by Leclerc, whilst the cast-iron basin surrounding it is by Bechu, both of Paris.

NEW DIGGING OR LAND CULTIVATING MACHINE.

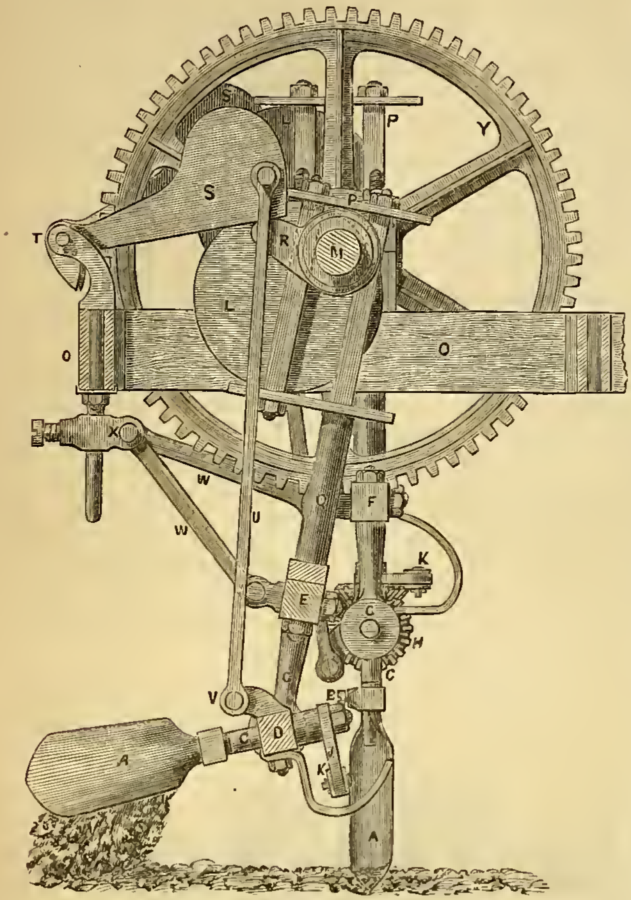
We recently inspected a well-executed working model of a Digging or Land Cultivating Machine, invented by Mr. J. D. Phillips, engineer, at the works of Adolph Keleeom, in Ghent. This model is at present in the possession of Mr. Mechi, of Tiptree Hall, who informed us that he had tried its working capabilities at his farm, and that it accomplished its business in a most creditable manner, although made on the reduced scale of 1½ inches to the foot. We think the machine deserves the attention of our agricultural machine makers, and we have accordingly engraved those parts of it wherein lies its chief novelty—viz., the actual digging portion of the machine. Fig. 1 represents a front elevation of the digging mechanism, one set of the spades being in the act of entering the ground, whilst the other set is turned partially over so as to deposit the sods. Fig. 2 is a vertical section of the diggers, taken at right angles to fig. 1. The actual diggers consist of a series of spades, A, which are slightly pointed at the lower end, and are fitted by means of set screws, B, on to the spindles, C, for the convenience of removing any one of them when injured. The motion of these spades is precisely similar to that of an ordinary spade in hand-digging. The spindles, C, turn freely in the bars, D, of the digging frames, E F. These bars work on centres in the end supports, G G, to which are secured the fixed bevel pinions, H, which gear into corresponding bevel pinions, I, fast on the two outer spindles of each series of diggers. A short lever arm, J, is fitted on to the upper end of each of the digging spindles, and each series of levers is connected by separate and distinct connecting-rods, K K, so that the spades in each frame may turn over simultaneously. An upward and downward motion, for the purpose of forcing the spades into the soil, and then of removing them, is imparted to the two digging frames, E F, by means of the two pairs of eccentrics, or cams, L, fast on the shaft, M, which works in bearings, N N, carried by the wrought-iron framing, O, of the machine. Their eccentrics work inside the heads, P P, of the rods, Q Q, which are secured at their lower extremities to the digging frames, E and F. Two cams, or wipers, R R, situated between each pair of eccentrics, and keyed on to the shaft, M, elevate during their rotation the levers, S S, which work on fixed centres at T. To the free ends of these levers are jointed the connecting-rods, U U, which are connected at V to an eye fast on the front of each of the bars, D. By this arrangement, as each of the levers, S, is elevated by its corresponding cam, R, it partially turns the bar, D, connected with it, and brings the shanks of the spades into a horizontal position. This movement of the bar causes the bevel pinion, I, to roll over the surface of the fixed pinion, H, and consequently turns all the spades over in such a manner as to turn and deposit their sods on the surface of the ground, as shown by the section, fig. 2. The upper portion of each of the digging frames, E F, is connected with a pair of radius bars, W, which work on fixed centres at X. These radius bars are for the purpose of causing the spades to enter the ground in a curvilinear direction, so as to enable them to get well under the sods and raise the earth with them. The eccentrics and wipers on the shaft, M, for each set of

Fig. 1.



diggers, are set at right angles to each other, so that as one set of diggers is about to enter the ground, the other set is just depositing the newly raised sods. The machine is supported on two pairs of broad rollers, and made self-locomotive, a slow rotatory motion being imparted to the hind pair of rollers during the operation of digging. All the movements are obtained from a pair of steam engines, the cylinders of which are placed in a slightly inclined position on each side of a vertical boiler, near the front end of the main framing, to which framing the two cylinders are bolted. The connecting-rods of the engines are jointed to studs situated at right angles to each other, on two discs keyed on to the opposite ends of the first motion-shaft, which is fitted with a heavy fly-wheel, and carries a spur-wheel which drives the large spur-wheel, Y, on the shaft, M. A train of gearing, worked from the main shaft, imparts the requisite slow motion to the driving rollers. Mr. Phillips has adopted an ingenious arrangement for feeding the boiler with water without the aid of pumps. The feed-water is contained in a separate vessel, connected at its upper part with the upper part of the boiler by means of a steam pipe, whilst a corresponding water-pipe connects the bottom of the feed vessel with the lower part or water-space of the boiler. When the communications in both pipes are open, the pressure on the feed-water and on the surface of the water in the boiler is balanced; and as the feed-water vessel is situated above the level of the water in the boiler, it follows that the feed-water will run into the boiler by the mere force of gravity. The supply is easily regulated by opening or closing more or less the communications with the boiler.

Fig. 2.



NASMYTH'S STEAM-HAMMER, WITH WILSON'S CYLINDRICAL VALVE.

By Mr. R. Wilson, *Low Moor Iron Works, Bradford.*

(Illustrated by Plate 179.*)*

The wonders of Mr. Nasmyth's invention, the "steam-hammer," have just received new lustre at the hands of Mr. Wilson, to whom belongs a large portion of the credit attaching to the early practical development of the beautiful automatic action of this invaluable tool. The special feature which Mr. Wilson has introduced, is his balanced pressure cylindrical valve, several modifications of which we noticed in our pages of June and July last year. Hammers divested of all self-acting apparatus whatever, and fitted merely with a hand-geared valve of this kind, exhibit an immensely improved action, enabling the workman to obtain the exact kind of blow he wants under all circumstances. This adjustment of the hammering force is attained just as effectually as with the simple hand-hammer of the smith; one stroke giving, perhaps, a mere touching tap, and the next, a blow of the highest intensity. Hence the newly-arranged hammers are great favourites with the men who work them.

Our Plate 179 represents two views of a "Nasmyth" steam-hammer, as modified in its valvular arrangements to Mr. Wilson's views. Fig. 1 is a front elevation of the hammer, showing its valve-chest, as replacing the original slide-valve. Fig. 2 is a corresponding side or edge view, taken at right angles to fig. 1. In these views, A is the cylindrical valve-chest attached to the old facing by a set of bolts passing through new bolt-holes bored in the facing, as the new chest is much smaller than the old one. The valve is worked by the short horizontal spindle, B, passing through a stuffing-box, C, in one of the end covers of the chest. The outer end of this spindle is supported in a bracket bearing, D, bolted down to the platform of the hammer framing. Outside the bracket, on the end of the spindle, B, is a back balanced lever, E, jointed by one end to the upper end of a long pendent rod, F, passing down by the side of the framing standard to the level of the governing workman's hand. The lower end of this rod, F, is jointed at G to the cranked hand lever, H, which turns on a fixed stud centre, I, bolted to the framing. In working the hammer, this lever is simply moved up or down—an action which the character of the balanced steam-valve renders extremely easy. If the hammer is to be elevated, the handle of the lever is raised. If a blow is to be given, the lever handle is depressed; and in order that the intensity of the hammering blow may be regulated to the greatest possible nicety, the guard-plate, J, is fixed to the framing at a point close to the handle of the lever—the chained pin, K, being contrived for insertion in the guard-plate holes at any desired height, for the purpose of defining the shift of the lever, as required for any special blow. The greater the range, or the more the handle is depressed after the elevating shift which has carried up the hammer, the more intense will be the descending blow. Hence the less the handle is depressed beneath the point at which the hammer is kept suspended by the steam pressure beneath its piston, the more gentle will be the hammer's downward traverse. But a little practice renders the guard-plate quite useless, as the men who are accustomed to work the valves very quickly find out for themselves how to give a blow of any necessary temper. It is this which brings even the largest hammers under the fullest control of the operator.

To prevent accident, however, under the management of an inexperienced man, a safety lever, L, is provided, the action of which is such, that if the hammer should at any time rise too high, the actuating steam is shut off, when the hammer gently descends like a piece of cork. This safety movement is equally as simple as the rest of the details. The lever, L, which is adjusted at an angle with the vertical line, is set upon the inner end of a short stud shaft, working in the long stationary bearing, M, bolted to the main frame. The outer projecting end of this short shaft carries a lever, N, jointed by its free end to the lower extremity of the rod, O, the upper end of which reaches to the level of the steam-valve spindle. This upper end of the rod is slotted longitudinally, to fit upon a stud pin fast in the side of the steam-valve lever, E. This slot allows of the ordinary working traverse of the lever, E, to its full extent, as actuated by the great hand lever below; the safety lever, L, not being the least affected thereby. When the hammer rises to its greatest elevation, the end of the inclined lever, L, coming in contact with the top of the hammer block, turns the short lever, N, upwards, and the consequent ascent of the rod, O, carries up the lever, E, turning round the steam-valve just so far as to cover up the ports, and cut off the ingress of the steam. This arrangement comes in well for full-length blows, as it communicates a slight depressing action to the hand-lever, H, when the attendant, taking the hint, depresses it still further, to give the proper blow.

Such of our readers as have examined the details of Mr. Wilson's balanced cylindrical valve, as previously illustrated in our pages, will be at no loss to see how it acts in the present instance in directing the steam flow. The working steam comes from the boiler through the horizontal pipe, P. The curved end of this pipe delivers the steam to the central portion of the valve casing, A, whence it finds its way by longitudinally divergent thoroughfares to the two ends of the internal oscillating valve-piece, and thence to the steam cylinder port. The exhaust steam passes off by the branch, Q, on the other side. The steam-pipe has a throttle-valve at R, from which a vertical rod, S, detaches to the standing place of the attendant, who can adjust the steam flow by the handle, T.

The balanced valve used at the Low Moor Iron Works, where the ex-ate 180.

RAILWAY BUFFING & DRAWING APPARATUS,

E. D. CHATTAWAY. EDINBURGH. PATENTEE.

Fig. 1.

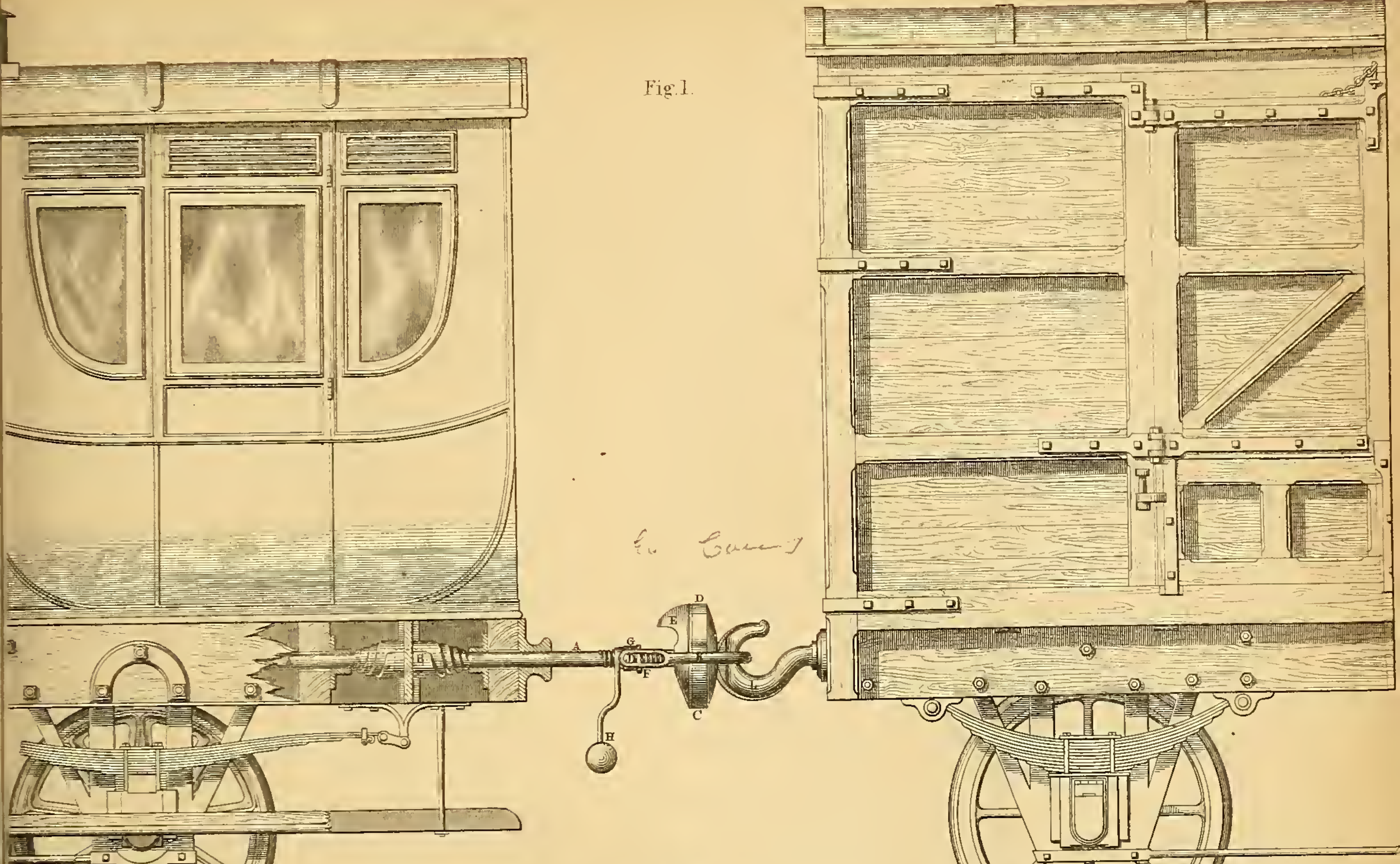


Fig. 2.

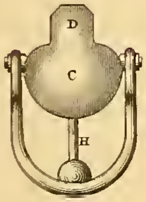
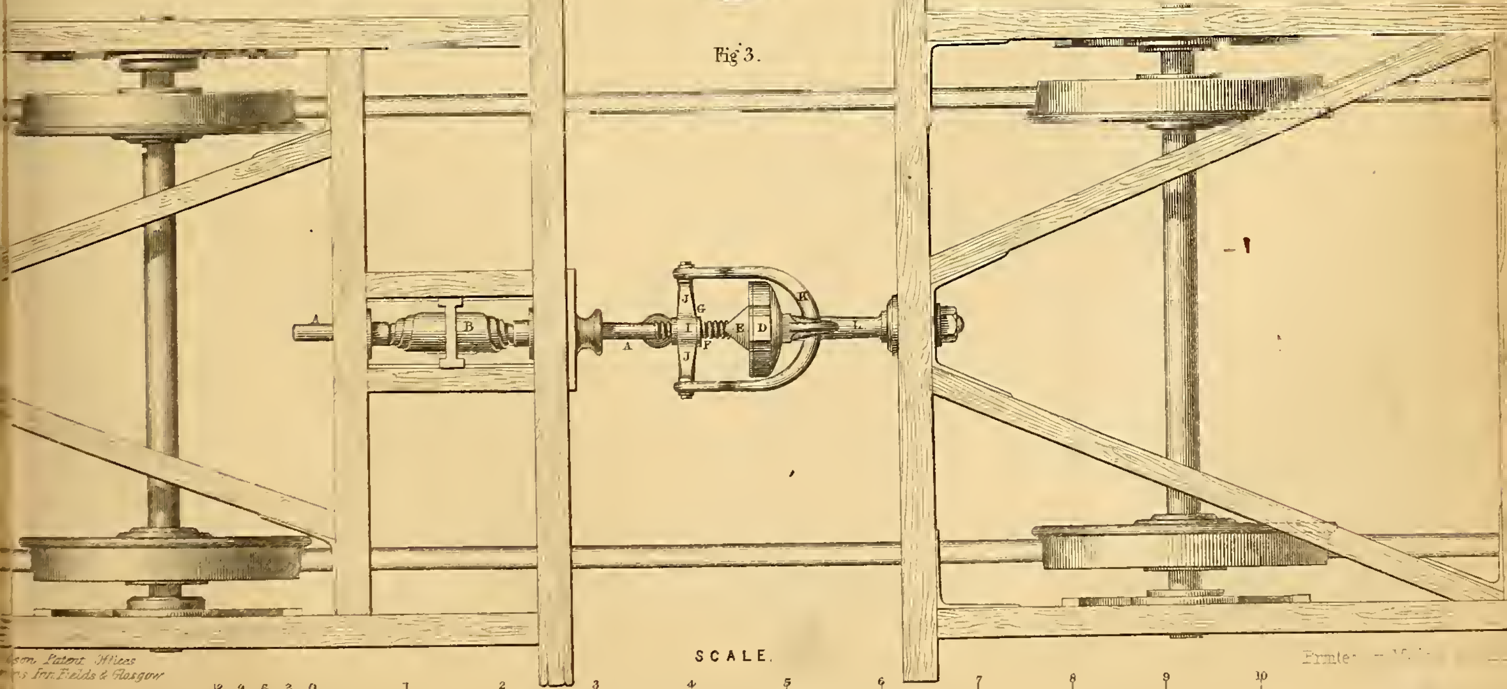


Fig. 3.



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STEAM HAMMER WITH BALANCED VALVE,

R. WILSON, LOW MOOR IRON WORKS, PATENTEE.

Fig. 1

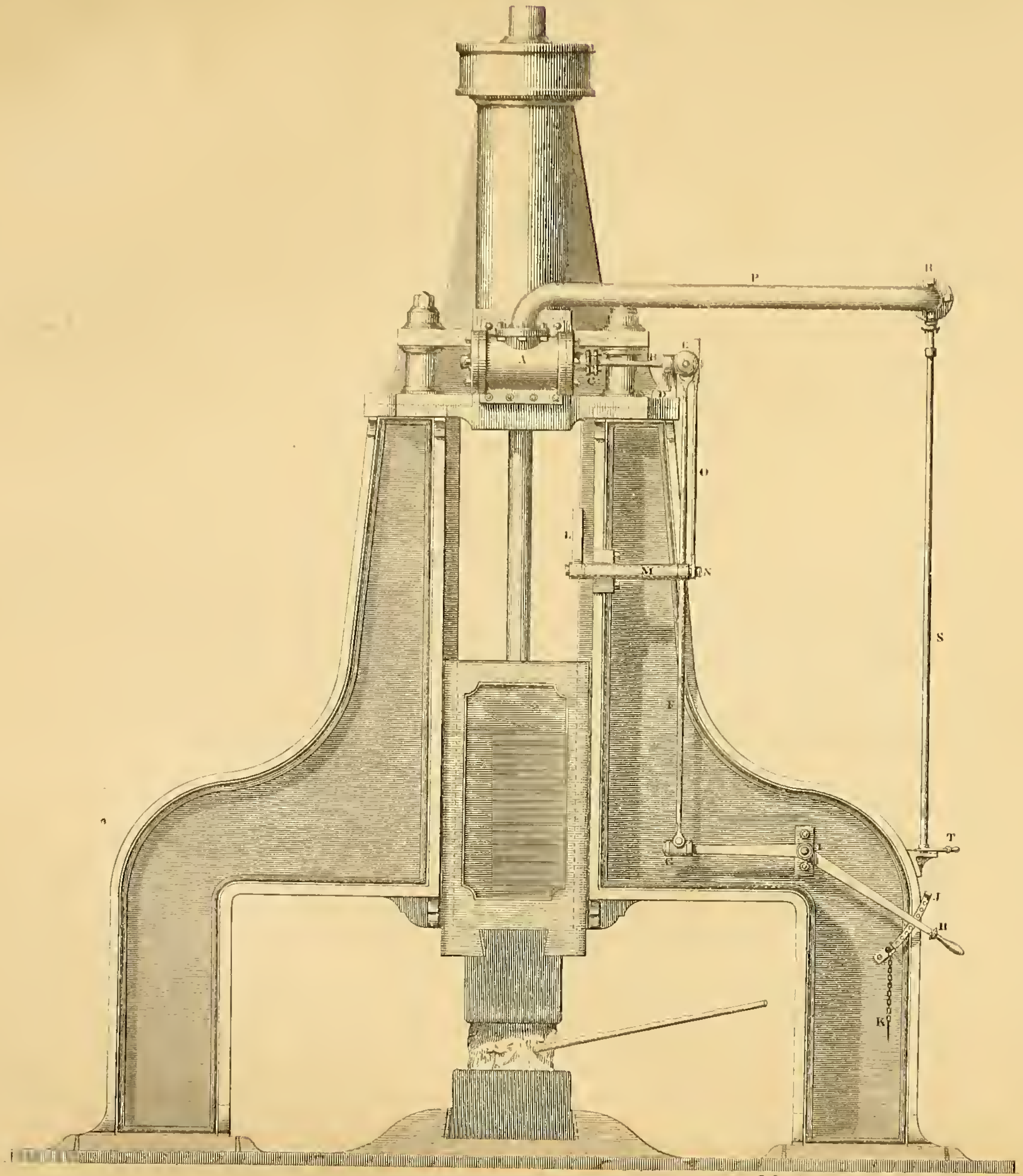
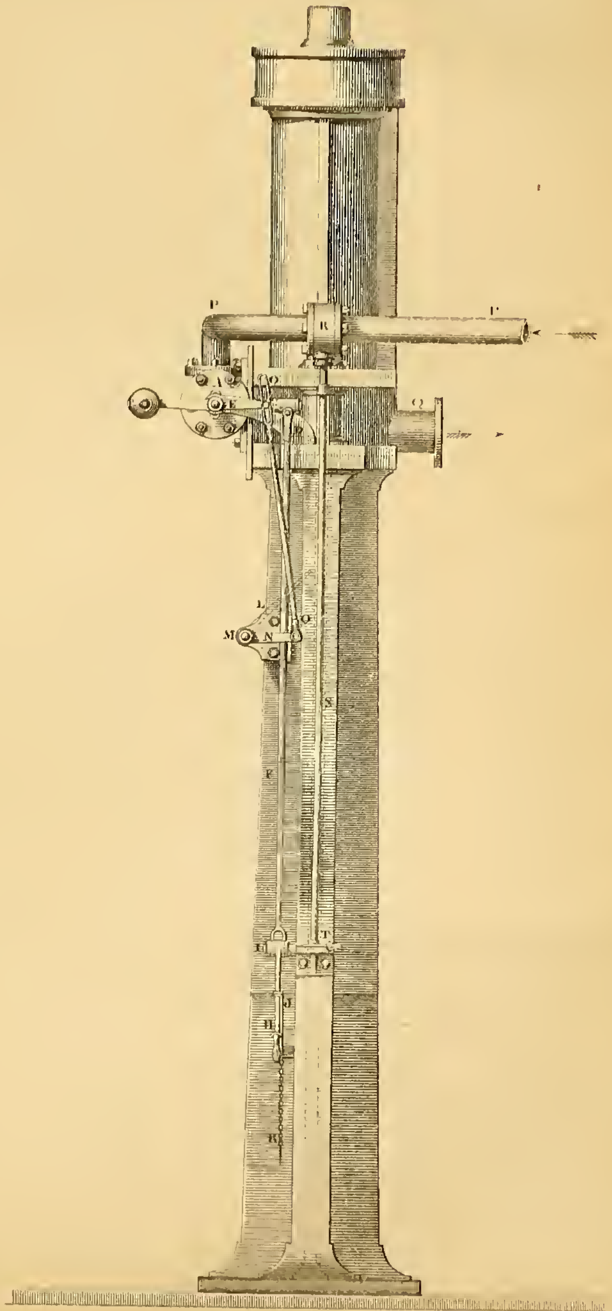


Fig. 2



SCALE.

periment was first tried, is eight inches in diameter, with ports fourteen inches long, by two inches wide. The steam pressure is 60 pounds, and yet a child of three years old could move the valve with ease, by working a sixteen-inch lever; so that with these improvements, coupled with certain others in the furnaces, the Low Moor forge-men can now do as much work with this hammer in nine or ten hours, as they formerly could, even with Mr. Wilson's last patented self-acting motion, in eleven or twelve hours.

Although this is a most beautifully suitable application of the valve, it has found many other important uses. The makers have now above a hundred of them at work for winding and common steam engines. With the winding engine-men they are special favourites. In one case, where two 30-horse engines are fitted with them, the owner states that he saves £120 a year by each in oil and labour, whilst he gets more work out of his steam. A great fact in their favour is, that since their first fitting up they have not cost a shilling in repairs.

CENTRAL BUFFING AND DRAWING APPARATUS FOR RAILWAY CARRIAGES.

By Mr. E. D. Chattaway, *St. Margaret's Station, North British Railway, Edinburgh.*

(*Illustrated by Plate* 180.)

Messrs. John Spencer & Sons, the well-known spring and railway fitting makers of Newcastle, have just introduced a simplified improvement in railway buffing and coupling apparatus, of a very important character. It is the patented invention of Mr. E. D. Chattaway, assistant locomotive superintendent on the North British line, and its effect is no less than the entire doing away with separate corner buffers and side chains, confining the buffing, coupling, and drawing actions to a single central rod. In this contrivance, the buffer and draw-hook are combined in one piece or arrangement; and to this end, the buffer-head, instead of being a plain circular disc, is made of a peculiarly irregular form, the lower portion being curvilinear, approximating to a semicircle, whilst the upper part is a long narrow projection. This upper projection, like the lower circular part, presents a buffing surface in front, whilst its inner side is shaped to represent a draw-hook, for the reception of the coupling link of the neighbouring carriage, which, being made wide for the purpose, works upon it as upon an ordinary draw-hook, thus forming a complete hook-and-link connection. The draw-rod is made with a screw thread near its end, just within the buffer-head; and upon this screwed portion there is fitted an adjusting nut-and-collar apparatus, with projecting arms, carrying a wide coupling link, working clear of the buffer-hook, and intended to gear with the common draw-hook of the next carriage, or with a buffer-hook, as the case may be. In this way the coupling can be drawn hard up or slackened off, as occasion may require.

Fig. 1, on our Plate 180, is a side elevation of the two contiguous ends of a first-class carriage and a goods waggon, as joined together in a train by Mr. Chattaway's compound buffing and coupling apparatus, all the parts being shown in external elevation, except a part of the carriage framing, which is broken away to exhibit the duplex spring upon the main buffer spindle. Fig. 2 is a plan of the carriage and waggon framing and coupling details, and fig. 3 is an end or face elevation of the buffer-head and coupling link detached.

These illustrative views convey very clearly the simplicity and excellent effect of the undivided central action of the single line of rods. The buffer and draw-rod, A, which is here connected to the framing of the carriage by a duplex volute spring, B, on Baillie's principle,* is the sole centre of the coupling and buffing operations. On this rod is the irregularly-shaped buffer-head, C, with its upper right-line production, D; hook formed on its inner face, as at E. The screwed portion, F, of the rod, has fitted upon it an adjusting nut, G, with a loaded pendulous setting lever, H. This nut is formed externally as a collar seat for the traversing collar, I, carrying two opposite projecting arms, J. The opposite ends of these arms are arranged to answer as the bearing journals for the two longitudinally-slotted ends of the wide connecting link, K, the curved end of which embraces the plain hook, L, on the buffer beam or framing of the waggon, on the right of the plate. This sequence in the train shows how conveniently Mr. Chattaway's coupling will work amongst the ordinary buffing and coupling apparatus hitherto in use. Of course, if the entire rolling stock on a line of railway was fitted according to the new plan, our plate would show a buffer draw-hook head on each carriage end, the wide link, K, on one rod, being passed over the buffer-hook of the other. It is this very feature of flexibility which gives this arrangement such a pre-eminent advantage over all previous suggestions for simplifying the buffing and coupling movements of railways. Railway officials are naturally averse to the introduction of isolated styles of action, for they bring with them numerous disagreeables, which last until the novelties are fairly and fully grafted upon the parent arrangements of the line. But here we have a contrivance which may either be carried out in its full integrity or not, whilst it entails no inconveniences, whether it is wholly or partially carried out.

Our engraving shows that the draw-hook on the waggon is flattened on its head, to afford a firm bearing against the buffer-head, so that a proper action is secured when the couplings are drawn hard up. In this condition, it is impossible that any escape from the draw-hook can take place, whilst there is little liability to fracture from sudden jerks, which happens every day with ordinary couplings.

The advantages of the new system may be summed up in very brief terms. But, first and foremost, the primary cost of the apparatus is only about half that of the common buffing and coupling arrangement. It is simple; its parts are few in number; simple, and easily fitted together. The coupling and uncoupling actions are accomplished by it with the greatest facility, and none of that objectionable shunting and hanging together of the carriages is required for slipping the coupling link over the draw-hook, as at present.

But the greatest feature of all is the introduction of central buffing, bringing the pressure action into one continuous central line throughout a train. This insures considerable saving in the wear and tear of the carriages and waggons, as the central position of the buffers causes the latter to receive the entire shock of the train when collapse takes place. Hence there will be little or no strain upon the framing, as with corner buffers. The constant tendency of the corner buffers is to force the tenons of the framing out of their mortices, as the two buffers on a carriage end are seldom or never struck at the same instant, or with the same intensity of force, whilst they are but rarely in line with the buffers with which they come in contact. Nor is this coupling liable to break away or get uncoupled, casualties which are at present most fruitful sources of serious fatalities.

THE PATENT LAWS.

At the last meeting of the British Association, this important subject came under consideration and discussion in the Mechanical Section. The committee appointed at the preceding meeting to report upon the Patent Laws presented their report, which stated in substance, that under the new patent law, which came into operation on the 1st October, 1852, more than £50,000 per annum is raised from inventors seeking letters patent. The raising of so large a sum of money, no less than its present appropriation, may be regarded as symptoms of disease in the patent system, and of defect in its administration. If the benefits conferred on the public by inventors are to be rewarded by giving them exclusive property in their inventions for a limited time, the funds levied on inventions, before they have had sufficient time to gather in part of their reward, ought not to be applied to purposes foreign or antagonistic to their interests, but such funds, if levied, should so far as possible be devoted to the encouragement of inventors and the advancement of practical science. Of such an appropriation, inventors as a class would have no cause to complain. On considering the steps to be taken by the committee for attaining the object of their appointment, the administration of the new patent system appeared to present material obstacles to efficient progress. The law officers of Scotland and Ireland are excluded from its administration, and the whole responsibility is devolved upon the Lord Chancellor, the Master of the Rolls, the Attorney-General of England, and the Solicitor-General, whose other official duties are so numerous and engrossing as to prohibit their affording proper attention to the matter. Persons practically acquainted with the requirements of the system intended to be established ought to be called into co-operation, and for this purpose ample provisions and powers are contained in the Act.

After this report had been gone through, Mr. M'Quorn Rankine read a paper on the same subject, in which, whilst acknowledging the benefits derived from the amended patent law, he pointed out the following defects in its operations as subjects for discussion in the Section:—1. The granting of patents for useless inventions; 2. The granting of a patent for an invention during the currency of provisional protection of the same invention previously granted to another inventor; 3. The granting of patents for foreign inventions to persons other than the inventor or his assignee.

In the discussion which followed, Mr. Fairbairn said that the majority of the committee appointed to consider the subject at Manchester, were of opinion that there ought to be free trade in patents as in manufactures, and £5 was considered a sum sufficient to pay for a patent. It was thought, that although a great number of useless patents might come forward, yet, after all, they would give encouragement to every description of inventions; for, although some might not be applicable to the purposes first in view, yet they might suggest valuable ideas.

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* Page 199, Vol. IV., *P. M. Journal.*

Mr. Webster spoke of the new patent law as an instalment, but not all that was wanted. The point on which the greatest conflict of opinion existed, was that of a uniform low fee. The objection to this was, that a great number of persons would be decoyed on by hopes of fortune to make fruitless inventions, and it would be a fraud on them to give them a patent. He was not aware of any single witness who was examined before the committee in 1851,—which was the most elaborate inquiry which had been made in any country, except the bulky report by the American Commissioners,—who advocated free trade; and for this reason, that inasmuch as it would consist generally in the application of known laws, which persons of ordinary experience could pronounce to be possible or impossible, it would not be right to afford that encouragement which the hopes of a fortune would hold out to speculative men. Lord Granville and some few other persons had recently expressed an opinion that the whole patent laws were a fraud on the public, and the sooner they were swept away the better. But, with these exceptions, he was not aware that anybody who had studied the subject held that opinion. He asked how they could draw a distinction between invention and copyright? It was labour of mind; and the question was just one of brains against capital, which would go on as long as society existed. Most of the objections pointed out by Mr. Rankine were provided for in the law. They had all been started and discussed, and there was provision for every one of them. There was no fear of much interference from foreign patents. It was a notorious fact, that the greatest inventions required a vast amount of perseverance and capital to force them before the public. It was not to be expected that a man whose old machinery would be rendered worthless by a new invention would encourage it, and the masters always discouraged invention in labourers. It did not follow, because an invention had secured a foreign reputation, that it would be immediately diffused in Britain, as was witnessed by the cases of the electric telegraph and galvanized iron.

Sir David Brewster thought that patents should be given gratis; nay, that a bounty should be given by government for every patent, however fruitless. They wanted a great number of inventions; it was an advantage to the public as well as to the patentee. Patents should be absolutely protected, and he could not see the smallest evil that could arise from fruitless patents. No patent could be said to be strictly fruitless. It was on a person seeing a want, and trying to supply it. He might supply it in an imperfect way, but at last others would be attracted to the work, and this fruitless idea came out as the germ of some better idea in the future. It was in consequence of want of encouragement to improvements on implements of war, that we have been so much perplexed of late.

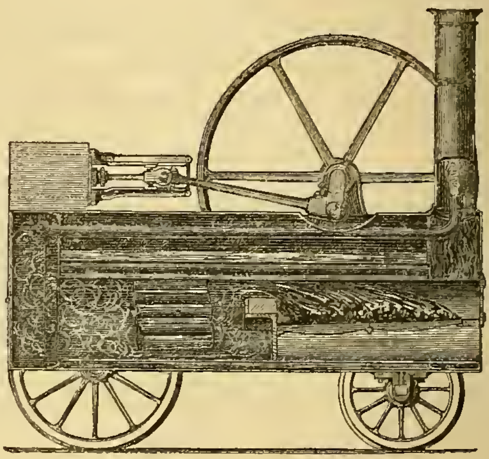
Other persons joined in the discussion, some of whom, without going so far as Sir D. Brewster in recommending bounties to be given to inventors, expressed a wish to see patents granted without charge, and for a longer term than at present.

Before the members of the Association dispersed, the following resolution relating to patents and inventions was adopted:—"That the Duke of Argyll, the Earl of Harrowby, Sir D. Brewster, the Master of the Mint, Col. Sabine, W. Fairbairn, Esq., and Thomas Webster, Esq., be appointed a committee for the purpose of taking such steps as may be necessary to render the patent system of this country, and the funds derived from inventors, more efficient and available for the reward of meritorious inventions, and the advancement of practical science."

SIMPSON AND BARNES' FARMER'S STEAM-ENGINES.

The portable steam-engines which usually make the round of our agricultural shows, are far too handsome and costly, and present too many intricacies of arrangement, to square with the purposes of the farmer. They are not unfrequently got up with paint of divers colours in most questionable taste, and studded over with useless and inappropriate ornament, to the exclusion of fair and honest work upon a good design. If we are to look to the farmer as a good customer of the steam-engine maker, we must persuade the latter to offer more substantial inducements than he has hitherto been willing to give. Severe simplicity of parts, combined with determined regard to the rough work of the farmer, ought alone to guide the maker in his production of an agricultural engine. At present, the practical farmer, who very properly looks at his steam-engine as a mere drudge, and not as an ornament, is too often put off with a machine, on which the worker of curious ornamental forms, and the painter, have had more employment than the skilled mechanic. Repairs of the deranged complexities of such machinery are impossible in the retired rural districts where the engines are employed, and, after some fretful trials, they must either be sent to a distance for renewal, or thrown aside in disgust.

Taking the lead in a new order of things of this class, Messrs. Simpson and Barnes of Openshaw, near Manchester, have devoted considerable attention to the simplification of farmers' engines, both stationary and locomotive. Our illustration is a longitudinal section of one of the latter kind. The boiler of this engine is very good and simple. It consists of a plain cylindrical outer shell, of the same diameter from end to end, and having within it a second cylinder or flue tube, at one end of which is the furnace. The draught current passes from the furnace through this centre flue, and enters a smoke-box at the extreme end of the boiler. From the smoke-box, a series of return flue tubes, of 2 or 2½ inches in diameter, carry the current back to the furnace end, where there is also a smoke-box communicating with the chimney. Under this form, the tubes and ferrules are not subjected to such intense heat as is ordinarily the case. Doors are fitted at each end of the boiler, to allow of full examination of the tubes. The exhaust steam is carried into the chimney to aid the draught, as in a railway engine.



The engines are fitted to such boilers in various ways. For the larger sizes they are mounted on the top of the boiler, as indicated in our figure; the cylinder and its appurtenances having a sheet-iron cover fitted over it. This cover is made a good fit, and heat from the smoke-box is made to circulate round it; holes being made in the smoke-box roof for the entry of the gaseous current. This obviously improves the action of the working steam, and materially economises the source of power. The cover is screwed on in a simple manner, admitting of speedy removal when necessary, and an extension of it serves to shelter the piston-rod, guides, and all the working parts, being accessible only by a door under lock and key.

For smaller engines, Messrs. Simpson and Barnes use a modification of this arrangement, either mounted on wheels in a similar manner, or upon a pair of hollow pedestal feet of cast-iron, placed one under each end of the boiler. When the engine is to be removed, the supports are taken from beneath it, and the weight is borne by a couple of timber rollers, enabling two labourers to traverse the whole machine with great ease. The top of the boiler carries a neat and strong saddle-bracket casting for the engine, which is of the oscillating kind. One end of the saddle has upon it a pair of vertical standards, fitted with bearings for the cylinder trunnions, whilst the opposite end is similarly fitted with bearings for the crank-shaft.

The saddle, with the engine complete, is removeable from the boiler at pleasure; so that the engine can be set to work inside a building, whilst the boiler is outside. The oscillating engine comes in well for this purpose, from its compactness—a point which is so vitally essential in agricultural machinery.

Mr. Simpson, the senior member of the firm, whose work we have just reviewed, was the fortunate winner of the £200 prize given by the Liverpool Dock Committee in 1845, for the best design for the landing-stage now erected at the St. George's Pier-head, with some alterations by Sir W. Cubitt.

THE LAW OF PATENTS IN SARDINIA.

By the Authors of the Patentee's Manual.

The present law of patents in this kingdom was passed on the 12th of March last, and the substance of it is given in this paper.

The author of a new industrial invention or discovery has the power of securing the monopoly of it for any period not exceeding fifteen years. But if the invention has been patented previously in another country, the Sardinian patent will expire at the same time as the original patent.

By an industrial invention or discovery, is meant one that has for its object—1°, a product or industrial result; 2°, an instrument, a machine, a utensil, an engine, or any mechanical arrangement whatsoever; 3°, a process or method of industrial production; 4°, a motor, or the industrial application of a power already known; 5°, lastly, the technical application of a scientific principle attended with immediate industrial results. In the last case the patent is limited to the results expressly indicated by the inventor.

An invention will be considered new when it was not previously known; or, if partly known, when the details required for working it were unknown.

Inventions previously patented abroad may be patented in Sardinia, if not already brought into the kingdom and put into practice.

Inventions relating to matters contrary to the law, to morals, or to the public safety; inventions which have not the production of material objects in view, and purely theoretical inventions—cannot be protected by patent, nor can any kind of medicinal preparation. An invention relating to alimentary substances will be referred to the Council of Health, who will decide whether a patent should be granted. At the time of applying for a patent, a tax is paid to government, calculated at the rate of ten francs for each year applied for. There is in addition an annual tax, which gradually increases from 30 francs for each of the first three years, to 110 francs for each of the years beyond the twelfth. The first year's annuity is paid at the time of application for a patent. The total cost of obtaining a patent for fourteen years, irrespective of the annual payments, is about £21. The annual payments must always be made in advance. A patent does not warrant the utility or the reality of the invention or discovery.

The utmost extent of a patent is fifteen years; the shortest term is one year. The commencement of the term is always reckoned from the last day of the months of March, June, September, or December, nearest to the day of application. A patent originally obtained for less than fifteen years may be prolonged, but so that altogether its duration is not more than fifteen years.

Patents for subsequent improvements, by way of addition, may be applied for during the existence of the original term, and for these the tax is twenty francs only.

The length of time for which the patent is desired must be stated in the petition. The same petition will not be allowed to apply for more than one patent, nor will more than one invention be permitted to be included in one patent. A description of the invention, with such drawings and models as may be required for the comprehension of the description, must accompany the petition. And if the patent applied for be for an imported invention, the original title, or an office copy of the title authenticating the foreign patent, must be added to the petition. The description may either be in the French or Italian language. It must contain a full and precise statement of the details required to be known by a skilful person, in order to carry into effect the invention or discovery.

Within six months from the commencement of the patent, the patentee may disclaim any part of his description on paying a fee of forty francs. Within this period, the patentee alone shall have the right of applying for improvements of the invention.

When a patent has been refused for any reason, the applicant may appeal to a board of scientific men annually appointed for the purpose of hearing such appeals.

Assignments of patents must be registered, and will only have effect, as regards third parties, from the date of the registry.

Patents will be void if the invention be one not legally patentable; if the title and the real object of the patent do not correspond; if the description accompanying the petition is incomplete or deceptive; if the invention be not new, or does not relate to some branch of industry. It will also become void if an omission takes place to pay the annual tax at the proper time; if, being a patent for five years or less, the invention shall not have been put into practice within the space of one year from the date of the patent; if the practice of it shall be suspended for that space of time; if, being a patent for more than five years, the invention shall not be exercised for two years, dating from the commencement, or if the practice of it shall be suspended for that space of time.

All the business regarding Sardinian patents is transacted at Turin. The official gazette publishes every three months the list of patents granted during that time, and, every six months, the descriptions and drawings of patents obtained during the preceding half year are published.

PROCESS FOR EXTRACTING ESSENTIAL OILS, AND PURIFYING MERCURY.

A new process has lately been brought into use in France, which consists in passing a current of steam over the matter containing the volatile substance. The steam acts at the same time as a calorific and as a mechanical agent, carrying away with it the volatile substance into an adjacent vessel, where it is condensed. This process may be very usefully employed in the treatment of turpentine, common tar, or tar obtained by destructive distillation, and also for purifying any volatile substance from extraneous matters. The steam may be of the temperature of 212° Fahr., when the substances that contain the volatile matter will allow it to escape freely, such as the leaves and flowers of odoriferous plants; or when the substance is liquid, as in the case of coal-tar; or when the substance under treatment liquefies at that temperature, as bitumen. Very highly heated steam must be employed when the substance to be treated requires a higher temperature than 212° to melt it, as well as in those cases when the volatile matters are more easily or abundantly extracted at a high temperature.

There are some substances—such as resins and caoutchouc—which, though they do not contain any volatile matter in a state of mechanical mixture, may be made, under the application of a high temperature, to yield it, in consequence of their constituents separating and re-forming themselves into such volatile matter. Treated with highly heated steam in the way proposed, such volatile matter passes over with it. The highly heated steam may be obtained by conducting ordinary steam, as it issues from the boiler, along pipes heated by a separate furnace. Mercury is one of the substances which requires a high temperature to vaporize them. By subjecting the metal to steam heated to rather more than 800° Fahr., it is converted into vapour, which will pass off along with the steam into a vessel, where it condenses in a very pure state.

The distilling apparatus is composed of a receiver of cast or wrought-iron, containing the open vessel, in which is placed the mercury or its amalgam. A metal worm connects the receiver with the boiler where the steam is formed, and the worm is conducted through or over a furnace of its own. The steam, having been thus heated to the required temperature, enters the receiver containing the mercury, which, being thereby vaporized, passes over along with the steam into the condenser.

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RECENT PATENTS.

LOCKS.

R. M'Connel, *Glasgow.—Patent dated September* 25, 1854.

The art of lock-making seems always to be a step behind that of lock-picking. The lock-picker generally moves ahead with some novel and ingenious mode of operation, and the lock-maker follows him with a contrivance specially designed to baffle his new device. In Mr. M'Connel's improved lock, this is partly, but not altogether, the case. One of the principal features of the lock is the giving of a slight reverse movement to the bolt previously to its being shot into the lock. In picking a tumbler lock, the common practice is to put a backward pressure on the bolt, and then shift the tumblers until they let the bolt fly back. This mode of proceeding would be quite useless with Mr. M'Connel's lock, as the bolt has first to move in the opposite direction; whilst, even if the lock-picker is aware of this, he will be unable to open the lock by any similar means. The lock, however, possesses several other precautionary contrivances. The bolt and tumblers and the key are so constructed, that the double motion of the bolt is effected in the regular course by turning the key in one direction only, as in ordinary locks. In moving the bolt, when unlocking, the key first acts on an incline formed upon the under side of the bolt in such a manner as to force the bolt outwards, although the key is itself turning in the other direction. On continuing to turn the key, the bolt, after being moved outwards, returns, and is shot back into the lock in the ordinary manner. The bolt carries the usual stump, which works in the openings made in the tumblers, these openings being formed to suit the peculiar motion of the bolt. The first action of the key on the tumblers is to slightly raise as many of them as are necessary in order to bring the stump exactly opposite a short passage directed outwards, the stump then moves outwards, until it reaches a passage formed in the tumblers at right angles, or nearly so, to the bolt, and the tumblers are raised to allow the stump to pass down this passage. The raising of the tumblers brings the stump opposite a passage which is parallel with the bolt, and along which the stump passes whilst the bolt is being shot back into the lock. Finally, the tumblers fall slightly, and the stump remains in a recess on one side of the passage last mentioned. It follows, hence, that the stump moves in four different directions as regards the tumblers; and notches being formed at the several points where the change in the direction takes place, the chances against getting the tumblers into the proper positions for moving the bolt, these positions also having to be different at different stages of the operation, are considerably increased. Increased variety and complexity is given to the movements of the tumblers, by forming irregular notches on them where the key acts upon them, in such a manner that they are moved by the side of the key, instead of, or as well as, by the point; and the acting surface of the side has consequently to be accurately formed relative to the centre of motion of the key. The key is also constructed in a novel manner, and with a view of obtaining greater security, namely, with the points which act on the bolt, and on the several tumblers set apart from each other, being bent, as it were, to different sides and in different degrees. The pin upon which the key barrel is entered is made oval, or is flattened or grooved at one side, and one or more pins are fixed to the key barrel, being made to project inwards, so that, on turning the key when in the lock, the pin may in certain positions be forced to one side, or turned by the action of the pin inside the barrel on the full side of the pin or pipe piece, and notches or grooves may be cut on this last piece to suit the pins in the key barrel. The security of the lock is also further enhanced by the application of a moveable shield to the keyhole. This shield is formed with a central opening through which the shank of the key can pass, and with two openings through which the bit of the key can pass—these, of course, communicating with the central opening. The shield oscillates upon a pin above the keyhole, and at its back carries a pin which prevents one or more of the tumblers from moving when either of the bit openings in the shield are opposite the outer keyhole. The shank of the key is provided with a pin, which acts on the shield plate so as to turn it to the position proper for releasing the tumblers after the key is introduced.

Our engravings represent three inside views of a lock constructed according to the improved system. Fig. 1 is designed to illustrate the action of the bolt, fig. 2 that of the tumblers, and fig. 3 that of the keyhole shield, whilst an additional contrivance, in connection with the pin, and lying beneath the bolt, is indicated by dotted lines in fig. 1. The box, A, of the lock is constructed in the usual manner, and the bolt, B, which is represented as locked, is slotted at C, to slide upon the guide-pin, D, fixed to the case, A, of the lock. The pin of the lock, upon which the key turns, is at E. The key, F, is represented in fig. 1 as sectioned just above the lowest tongue, G, of the bit, this tongue being the one which moves the bolt, B. In fig. 1, the key is represented as just about to act on the bolt for the purpose of unlocking it. The point of the tongue, G, first acts on the inclined edge, H, of the bolt, this edge being of such a shape as to cause the bolt to be forced outwards a short distance when the key is turned. The key then turns onwards over towards the right hand, until the tongue, G, comes in contact with the back side, J, of the notch in the lower edge of the bolt, B, when it shoots back the bolt completely into the lock. The bolt is pressed inwards a short distance from its outermost position by a lever, L, actuated by a blade spring, M, and it is furnished with the usual stump, N, which projects through the openings in the tumblers. In fig. 2, one of the tumblers, O, is represented as placed over the bolt, B. Of course any number of tumblers may be employed, but it will be unnecessary to describe the action of more than one, as the practical locksmith will be able to vary the patterns of the several tumblers, and of the corresponding parts of the key to fit them, as is done in ordinary tumbler locks. The portion of the lower edge of the tumbler which is acted upon by the key, is formed with a projecting piece, P, which is thinner than the main body of the tumbler, and the key is correspondingly formed with a deep groove, into which the thin piece, P, enters, and is acted upon by points of the solid metal of the key bit within the recess or groove, an arrangement which considerably increases the difficulty of making a duplicate key. In fig. 2, the key is represented as about to act on the tumbler, O, so as to move it for the purpose of unlocking the bolt. The tumbler is first raised so as to enable the stump, N, to pass outwards at R, notches and projections being provided to catch the stump, if the tumbler is not moved into the precise position required. The bolt carries the stump, N, as far outwards as to bring it immediately opposite the vertical passage, S, in the tumbler. If it moves too far, or not far enough, it will be caught as before. The tumbler is next raised until the stump, N, is opposite the horizontal passage, T, and the same accuracy of action is required to enable the stump to enter this passage. The bolt is then shot into the lock, and carries the stump, N, along the passage, T—this passage being shaped so as to require various movements of the tumbler, to prevent the stump from being caught by projections or notches as it passes along to the point, U, where it remains as long as the bolt is unlocked. The earlier movements of the tumbler are produced by the action of the key on the thin piece, P, after which the projecting point of the key bit acts on the curved edge, W, of the tumbler, and produces the latter portion of the tumbler's movements; the reaction of the tumbler in each case being effected by the blade spring, X, in the usual manner. The tumbler, O, is formed with certain notches at Y, on its upper edge, which are con-

Fig. 1.

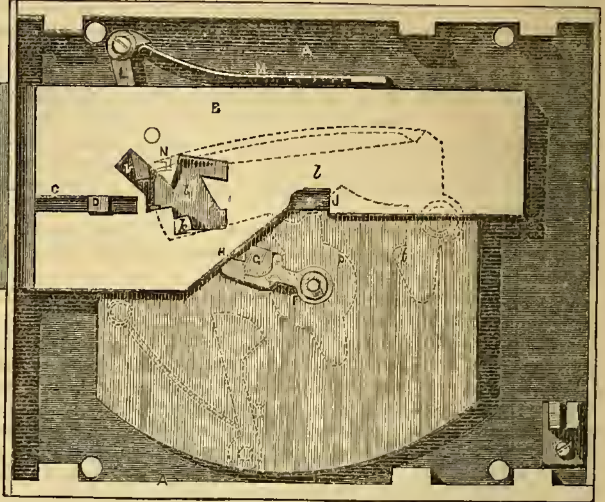
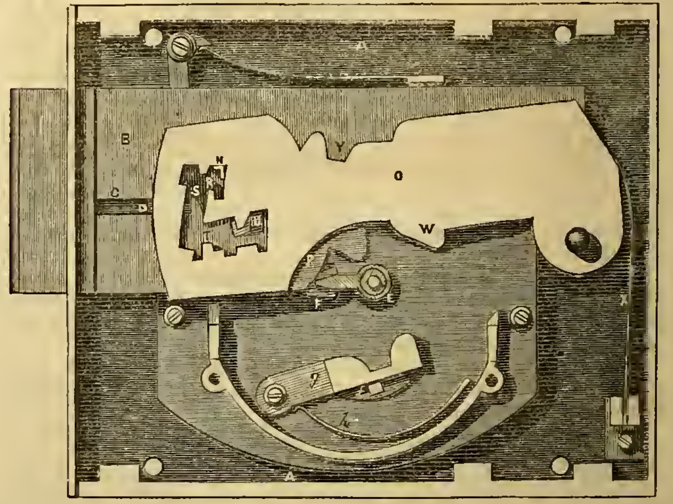
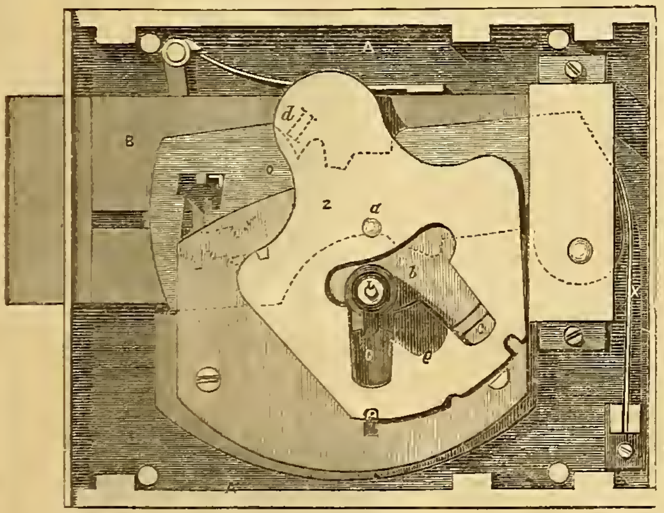


Fig. 2.



trived in connection with a shield, Z, represented in fig. 3. This shield is placed outside all the internal mechanism of the lock, and oscillates on a pivot at *a*, above the level of the keyhole. It is formed with an opening, *b*, to admit the key, this opening having two radiating portions, *c*, corresponding to the bit of the key. In fig. 3, the shield is represented in the position in which it is when the key is introduced for unlocking. In this position a projection on the back of the shield, indicated by dotted lines at *d*, prevents the tumbler, O, from rising. When the key is introduced and turned, it turns the shield by means of a projection on the under side of the latter, so as to bring the portion *e* over the lower portion of the keyhole, and at the same time releases the tumbler. After moving the bolt, the key turns the shield so as to obtain egress at the other aperture, *c*, and this movement of the shield again locks the tumblers. Thus, when there is an open passage into the lock, and it is consequently easier to introduce a lock-picking instrument, the tumblers are held stationary, and they can only be moved when the keyhole is entirely closed with the exception of the small annular space corresponding to the barrel of the key. The shield is held in its several positions by a pin, *f*, projecting up from beneath, and fixed upon a lever, *g*, acted upon by a spring, *h*, as is shown in fig. 1. The pin, *f*, enters notches in the shield, and is shifted out of them at the proper times by the action of the key on the lever, *g*. The fixed pin, E, upon which the key turns, has fitted upon it a tubular piece made to suit the peculiar internal construction of the key barrel, and also adding to the security of the lock, by acting on an additional stump tumbler, indicated by dotted lines at *l*, in fig. 1, and placed below or behind the bolt. This tumbler is called a "stump" tumbler, because, instead of acting like ordinary tumblers upon a stump fixed upon the bolt, it carries a stump, *k*, itself, which works in an irregular opening in the bolt. The tubular piece upon the pin, E, is formed with an inclined groove, which communicates with a comparatively wide opening. Inside the barrel of the key are fixed three pins projecting inwards, and on passing the key into the lock these pins enter the groove in the tubular pin-piece, and turn round this piece to a certain extent before the key itself is turned at all. This brings the pins inside the key barrel into the space in the tubular piece, and when the key turns, the pins act on either side of the opening, and carry round the tubular pin-piece along with the key. On the inner end of the tubular pin-piece is a small disc, indicated by dotted lines at *p*, fig. 1, formed with points, which act on the stump tumbler, *l*. When the bolt is locked, the tumbler, *l*, is raised; but on unlocking, a point of the disc, *p*, is brought against the point, *t*, of the tumbler, and throws it down, bringing the stump, *k*, into the position represented in fig. 1. After this another point of the disc, *p*, comes round, and acting on the tumbler, *l*, raises it so that the stump, *k*, enters the passage, *v*, in the bolt, whilst the bolt is moving into the lock. The disc, *p*, then gradually raises the tumbler, *l*, so that the stump, *k*, passes up the inclined passage, *v*, in the bolt, whilst the bolt moves to its inmost position in the lock. If from any cause the spring, M, and lever, L, should not be able to force the bolt fully back, the stump, *k*, will effect this by its action on the upper side of the inclined passage, *v*. All the movements of the tumbler, *l*, obviously require to take place at certain precise periods, corresponding to the movements of the other parts of the lock; consequently, great accuracy is required in fixing the points of the disc, *p*, and in forming the opening in the tubular pin-piece in a position corresponding to that of the points in the key barrel, whilst greatly increased difficulty is thrown in the way of the unlocking action of any instrument but the true key, by the narrow inclined groove through which the points in the key barrel have first to pass, before they can be brought into a position for turning the tubular pin-piece and disc, *p*, in a proper manner. In locking the bolt, the reverse movements of those hereinbefore described take place. A key, suitable for the kind of lock hereinbefore described, is constructed with a view of throwing great difficulties in the way of a fraudulent person desirous of obtaining a duplicate key by taking a cast of the true key. For this purpose the projecting portions of the key bit are made to overlap, whilst other portions are made with internal hollows, so that, if any material were applied to the key to obtain an impression or mould of it, portions of that material would necessarily be retained in the recesses, whilst at the same time the obtaining a correct impression of these internal points is of the more importance, as it is by them that a portion of the movements of the lock are effected, as already mentioned.

Fig. 3.

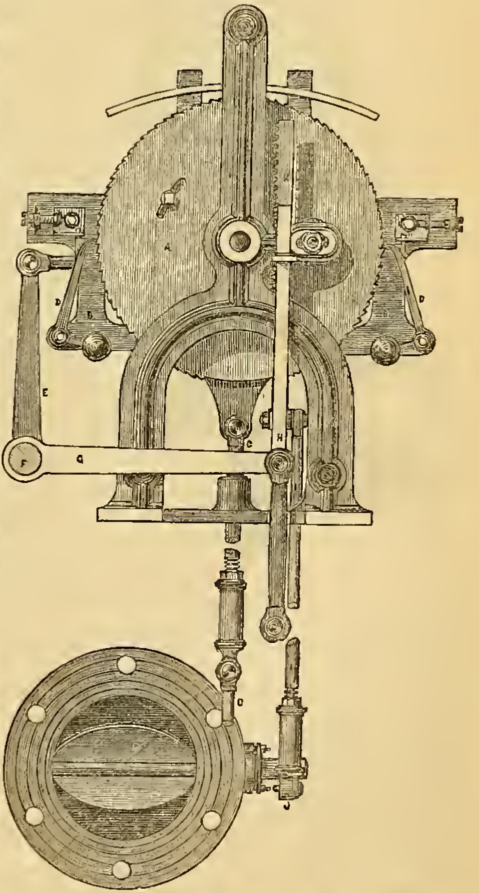


DIFFERENTIAL ACTION GOVERNOR.

T. Biggart & A. Loudon, *Dalry, Ayrshire.*—*Patent dated Oct.* 19, 1854.

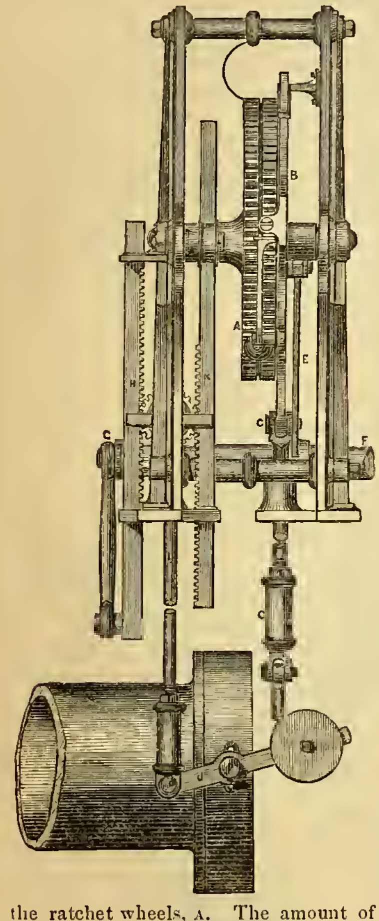
This is a complex apparatus, intended for appending to the common governor, to rectify the irregularities of action of that contrivance, and make thus secure a steadier rate of working of the engine under its control. Fig. 1 of our engravings is a front elevation of this supplementary regulator, and fig. 2 is a corresponding view at right angles. The details of the apparatus are carried in a light frame, consisting of two cast-iron standards, tied together by cross rods, and formed with centres for a horizontal spindle, upon which are fixed a pair of wheels or discs, A, formed with ratchet teeth upon the greater portion of their circumferences—the teeth on the two wheels being inclined in opposite directions. These ratchet wheels are acted upon by two weighted palls or catches, D, carried by an open frame, B. This frame, B, is jointed to a rod, C, which is connected to any reciprocating part of the steam-engine, and transmits a reciprocating motion to the frame, B, in a vertical direction, and the frame is formed with projections above, which work inside a segmental guide, screwed by a bracket to the frame of the apparatus. A rod is jointed to the frame, D, at any convenient point, by preference near the level of the spindle of the wheels, A, and this rod is jointed to the end of a lever, E, fast on a rocking shaft, F, through which the action of the ball, or other ordinary governor, is transmitted. The connections are so arranged, that when the engine is going at its prescribed rate, the frame, D, will be in such a position as to keep the two palls, D, clear of the ratchet wheels, A, and these ratchet wheels will not be affected by the vertical reciprocation of the frame, B. If the speed of the engine rises or falls, however, the lever, E, will shift the frame, D, to one

Fig. 1.



side or the other, so as to bring one of the palls into gear with the ratchet wheels, A, when the reciprocating motion of the frame will cause these wheels to turn as long as the pall is in gear with them. The motion of the wheels, A, induced in the manner just described, is communicated to the throttle-valve connections by means of a pinion fast upon the spindle of the wheels, A. This pinion is in gear with a rack formed on the upper end of a rod, K, which works vertically in a guide cast or fixed upon the framing, being made to move up or down, accordingly as the ratchet wheels, A, move in one direction or the other. Lower down, a rack is formed on one side of the rod, K, and in gear with this rack is a pinion, carried loosely on a pin at the upper end of a rod, I, which passes down and is connected to the lever, J, of the throttle-valve. The pinion carried by the rod, I, is likewise in gear with a rack formed on a rod, H, which slides in guides cast or fixed on the standard; and to the lower end of the rod, H, is jointed a link, which connects it to a lever, G, fast on the shaft, F. This arrangement of racks, acting upon a pinion on the rod which shifts the valve-lever, is adopted in order to combine the rapid action of the ordinary governor with the permanent action of the ratchet wheels and reciprocating frame. If the rate of the engine varies, the ball, or other governor, will turn the shaft, F, and actuate both the levers, E and G. The lever, G, at once shifts the rod, H, which causes the pinion of the rod, I, to roll up or down the as yet stationary rack, K, and so open or close the valve by means of the rod, I. When the engine returns to its proper rate, the lever, G, returns to its former position, and it would make the valve also return to its former position, were not the rack, K, in the meantime to descend by the action of the ratchet wheels, A, and the reciprocating frame, B, which frame has been put into gear with the ratchet wheels by the lever, E. After the engine resumes its proper rate, the valve stops at the point to which it has been worked by the ratchet wheels and reciprocating frame, and this point may either be a greater or less distance from its original position than that to which it is shifted in the first instance by the lever, G. When the engine is brought back to its proper rate, the levers, E and G, assume the positions represented in the figures, and the frame, B, is so situated as to keep both the palls, D, clear of the ratchet wheels, A. The amount of play between the points of the palls, D, can be regulated with the greatest nicety by means of guide plates, in openings in which projections on the palls are made to fall. These guide plates can be adjusted by means of screws, so as to allow the palls to fall more or less near to the ratchet wheels; that is to say, so that a less or greater lateral movement of the frame, B, will be requisite to make them act on the ratchet wheels. The ratchet wheels are not made with teeth completely round their peripheries; but there is on each a blank space, which is so situated that the wheels, A, will not be urged round after the valve has been fully opened or fully closed; so that if, after the valve is so shut or opened, the pall from any cause remains in gear with the ratchet wheels, and the reciprocating motion goes on, none of the parts of the apparatus will thereby be strained or injured. A friction piece is made to press on the face of one of the wheels, A, by the action of a spring fixed to the top tie-rod of the frame, by which means the wheels, A, are prevented from being jerked or turned round too far, or otherwise improperly shifted.

Fig. 2.

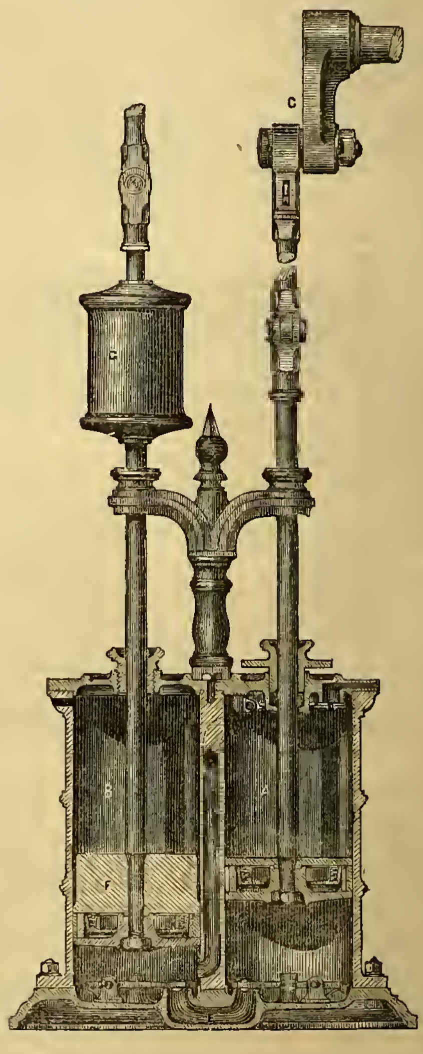


With this governing apparatus there is thus all the rapidity of action of the common ball-governor, without the back and forward vibratory movements of the latter.

PNEUMATIC GOVERNOR.

J. H. Johnson, *London and Glasgow* (Branche & Coste, *Paris*).—*Patent dated February* 14, 1855.

This invention relates rather to an improved and compact arrangement of the details of pneumatic governors for steam-engines and other prime movers, than to the embodiment of any new principle; and it comprehends also an improved packing for the pistons of regulators of this kind, as well as improved apparatus to be used when the governor is applied to the sluice-valves of water wheels or turbines. Our engraving represents a vertical section of the apparatus, which mainly consists of a pair of small cylinders, A, B, cast in one piece, the former acting as a force pump, and the latter as a receiver. The pistons of both cylinders are packed by means of slit rings, which are pressed against the sides of the cylinders by conical rings pressing upon them by means of springs, and lying between the top and bottom plates of the pistons. The piston-rod of the pump, A, is connected to a small crank, C, on a shaft driven by the engine, to which the governor is fitted, and the pump is thus driven faster or slower according as the rate of the engine varies. When the piston of the pump, A, descends, the air enters above it from the outside by a valve, which is shut by a spring, when the piston again rises. And, in rising, the piston forces the air which was above it down a passage formed at D, between the two cylinders, to the lower end of the cylinder or receiver, B. The air cannot return the same way, as the passage is defended by a valve opening into the cylinder, B. When the piston of the pump, A, rises, air enters beneath it by a valve opening inwards, and when the piston descends, this air is also forced into the lower end of the cylinder, B, by the passage, E, likewise defended by a valve to prevent the return of the air. The piston of the cylinder, B, is counterbalanced by means of the weight, F, and by another weight, G, upon the rod higher up. The air which is being continually forced beneath the piston of the cylinder, B, finds egress gradually through a passage between the cylinders at D, and parallel to the passage communicating between the top of the cylinder, A, and the bottom of the cylinder, B. This egress passage communicates with the atmosphere by means of an adjustable stop-cock. The piston-rod of the cylinder, B, is connected to the regulating mechanism of the prime mover, so that, when it rises, the rate of the prime mover will be reduced. Then as the air which is pumped into the receiver, B, can only escape at a certain rate, it follows that, if the rate of the prime mover increases from any cause, more air will be pumped into the receiver in a given time than can escape from it, and it will, consequently, have the effect of raising the



piston, which action will bring the engine back to its prescribed rate. On the prime mover going slower, the piston sinks as the air escapes from beneath it faster than it is supplied by the pump. The rate of the prime mover can thus be accurately determined, by adjusting the egress passage for the escape of the air from the cylinder, B.

PRINTING SURFACES.

JOHN CUNNINGHAM, *Beith*.—*Patents dated Aug.* 5, *and Sept.* 19, 1854.

These patents cover the important inventions of Mr. Cunningham, which are noticeable, not only for the ingenuity displayed in their primary conception, but also for the painstaking perseverance with which they have been elaborated and brought into practical form. To a certain extent these inventions comprehend the working out of the principle originally laid down by Mr. J. B. Graham, and published by us at page 130 of our last volume; but Mr. Cunningham's improvements go vastly beyond the primary arrangements adopted by Mr. Graham, and involve independent applications of the principle never contemplated by the latter, as we shall proceed to show. In carrying out the portion of the improvements relating to Mr. Graham's system, the pins or types which are to form the pattern matrix are depressed by prickers or depressing points, a row of eight prickers being arranged in a frame, which is depressible by a treadle, after the manner of the punches of the well-known "piano" punching machine for perforating Jacquard cards. In the frame containing the prickers, and in connection with them, a set of keys are arranged in such a manner, that on any of the keys being depressed, the corresponding pricker will be held, and will be caused to descend with the frame, and so depress the corresponding pin or type in the pattern matrix beneath, whilst such of the prickers as are not acted upon by the keys will not, on the descent of the frame, depress the corresponding pins in the pattern matrix. The frame containing the mass of pattern pins is made to shift at intervals beneath the prickers, so as to bring fresh portions within the sphere of their action, indices being provided by which the pattern frame may be shifted and adjusted with accuracy. This part of the operation may be effected by means of apparatus similar to that described at the latter part of the present notice. In operating with this apparatus, the pattern matrix frame is fixed upon the upper moveable frame, and the apparatus for depressing the prickers is so arranged as to act upon it in this position. The operator, having his pattern before him, then reads off as much of it as corresponds to the eight or other number of prickers, for which the apparatus is constructed, and depressing the keys indicated by the pattern, he causes the pricker frame to descend, whereupon the prickers depress the corresponding pins in the pattern matrix. The pattern matrix is then moved laterally, so as to bring a fresh portion of the pattern matrix under the pricker frame; and the operator, reading off another portion of the pattern extending over another series of pins, causes the corresponding prickers to descend as before. He proceeds in this manner to the end of that line in the pattern matrix, on completing which, he shifts the frames, carrying the matrix back or forwards, so as to bring a fresh line under the pricker frame, and reverses the transverse movement. This enables him to operate upon a second line of the pattern in the manner already described; and he continues working thus, from side to side, until the entire surface of the pattern matrix is brought into correspondence with the pattern.

Another portion of the improvements relating to the same system of producing printing surfaces, consists in causing rows of pins or types to stand up above the general level, along the borders or edges of the matrix, or built-up mass of pins or types used in producing the printing surface, so that the cast which is taken off the surface of the types may have its edges defined and shaped by such raised rows, in order that two or more casts of the same, or of different patterns, may fit into each other with accuracy. This is effected by depressing the body of the types slightly below the types at the extreme edges; thus, if types of an hexagonal section are used, the edges of the casts will be indented, so that they will lock into each other when fitted together. Another improvement consists in making the pattern types of two or more kinds of metal, or so as to present different appearances to the eye, as well as in arranging these in squares, or in regular compartments of any convenient form, each compartment being made up of types of one kind. This arrangement is for facilitating the reading off, and transferring the pattern from the original design to the block of types; and the paper pattern is to be ruled to correspond to the types, or the pattern is to be drawn upon paper suitably lined for the purpose, stronger lines or any other contrivance being employed to mark compartments, to correspond to the compartments formed by the different kinds of pins. Another improvement relates to the mode of taking a cast off the surface of the types, after certain of the types have been depressed to form the pattern. For this purpose, two plates of peculiar construction are fitted upon that side of the frame upon which the metal or other material for forming the actual printing surface is to be cast. These plates are made to draw apart, and are so constructed as to leave a winding or zigzag groove along their meeting or junction edges, immediately over the mass of pattern types. One of the plates may be of smaller size, the two being made to fit accurately together by means of wedge or dovetail grooves, and by pins placed at suitable points. Suitable arrangements are made for introducing melted metal for forming the casting at the back of these plates, the metal finding its way through the groove to the surface of the pattern types, and the casting produced will have a feather upon its back corresponding to the groove. The edges of the plates which form the groove are bevilled, so as to make the feather thicker at the outer edge, which enables the plates to take a firm hold of the casting; and this casting is forced off the face of the types by means of screws working in the plates, or otherwise. The arrangements preferred for introducing the melted metal at the back of the feather plates, consist in fixing a plate on the back of these plates, this outer plate being formed with a cavity in which a thinner plate is fitted. A groove, or channel, is formed between the thinner plate and the back plate, through which the melted metal is poured from one side, the whole frame being set on edge to bring this side uppermost. The frame being set in this position, the melted metal finds its way down the channel between the hindmost plates, and passes through a slit, formed by cutting away a portion of the bottom of the thinner plate, to the back of the grooves in the feather plates, and fills these, and covers the face of the pattern types as already described. It is preferred to cause the melted metal to enter upon the face of the pattern types at the lower side for the time being, so that, in filling up the matrix, it gradually rises upwards, expelling the air before it; this mode insuring the more certain filling up with metal of the intricate and minute spaces constituting the pattern. Before pouring in the melted metal to form the casting, the frame or matrix is heated, so as to prevent the too rapid cooling of the melted metal.

Another improvement consists in applying the matrix of pattern types to the production of indented metallic or other surfaces, resembling engraved surfaces. For this purpose the types are engraved with fine lines or any device on the surface of one end, and the pattern having been produced by causing certain of the engraved types to stand up from the general level—this being done by depressing these types from the other side, or otherwise—metal is cast upon the opposite side, so as to prevent the raised types from sinking when pressure is applied. The matrix thus formed into a solid block is used as a die for indenting metallic or other surfaces, by means of great pressure, this being effected in suitable apparatus, such as is in use for a similar purpose; and these blocks may be employed for indenting either rollers or level surfaces.

An arrangement of mechanism, similar to that described for depressing the pins of pin-matrices for producing printing surfaces, may be adopted for operating upon surface-printing rollers, or blocks, wherein the pattern is produced in relief in metal upon a wooden surface. If the object to be operated upon is a wooden roller, it is arranged on centres with its axis parallel to the row of prickers, and the pattern is marked upon it by the prickers in the manner already hereinbefore described, the the roller being turned round and adjusted when necessary by the aid of suitable indices. The block or roller may be set on the shifting frames already referred to, but still to be described. The same general system may be employed in marking out or producing patterns upon any surface, and the details may be varied in several ways, this part of the invention essentially consisting in producing or marking the pattern by means of prickers working in connection with keys, conveniently situated for the hand of the operator. The shift required, after each depressing action of the pricker frame, may take place either in the pattern surface or in the depressing apparatus; or both may be arranged to shift, one from right to left, and the other back or forward, or by turning round.

A modification of the last-described portion of the invention consists in substituting wires for the prickers or markers, which wires, on being entered into the wooden surface, are cut so as to leave short lengths in the wood to form the actual printing surfaces. The apparatus for working out this modification is represented in the accompanying engravings, fig. 1 being a vertical section, and fig. 2 a corresponding plan. The details of the apparatus are carried by a cast-iron framing, A, to which is bolted an arched bracket, B, passing over and across the frame to support portions of the depressing mechanism. This bracket, B, has bolted upon it at its centre two guide-checks, C, formed with vertical dovetailed grooves, in which slides the small metal frame, D. This frame is made to slide up and down by means of a lever, E, which oscillates on a centre pin carried by the bracket, B, and is jointed at its back end to a rod, F, passing down to a short lever, G, upon a horizontal shaft, H, carried in

Fig. 1.

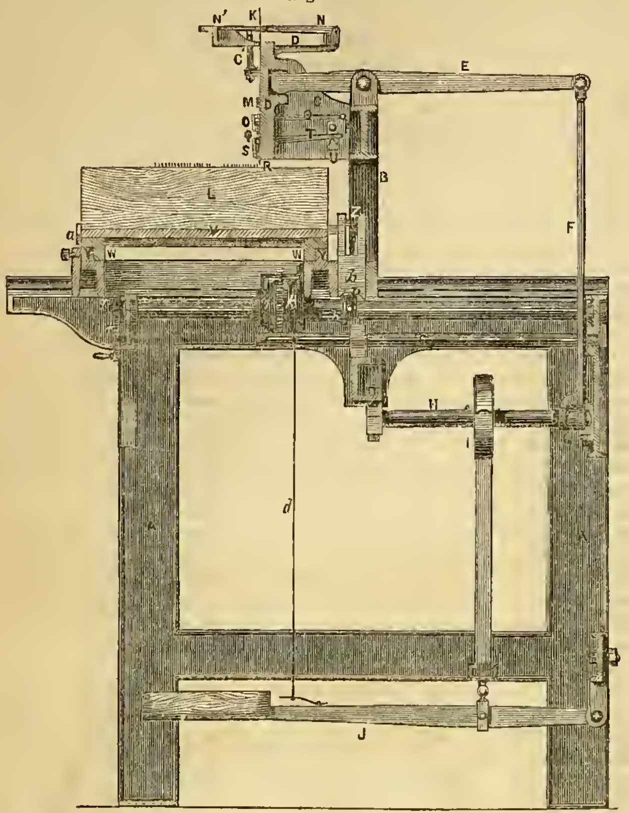
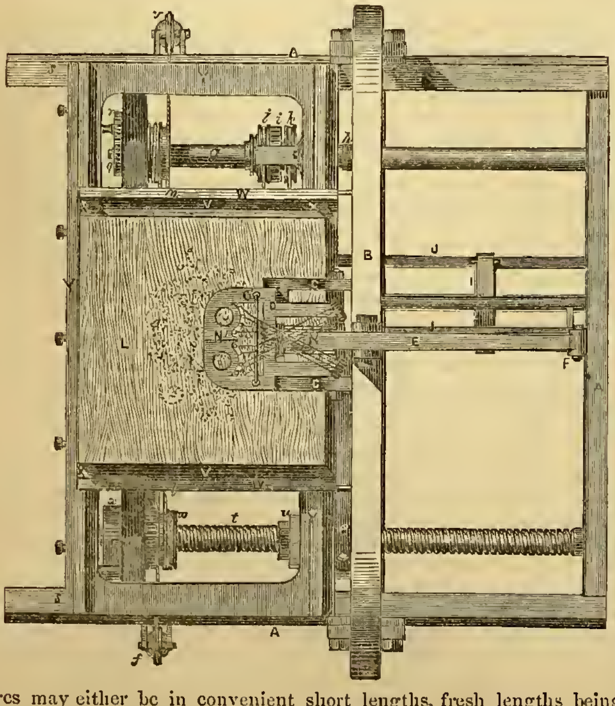


Fig. 2.



bearings inside the framing. The shaft, H, has fast upon it a pulley, I, over which is passed a belt connected to a pair of treadles, J. The wires, K, with which the pattern-printing surface is to be formed upon the block, L, below, pass down the face of the frame, D, inside of guides, M. These wires may either be in convenient short lengths, fresh lengths being supplied as those in the machine become used; or the wires may be coiled upon drums, being given off gradually as required. The wires, K, are at slight distances apart at the upper part of the frame, D, but they gradually converge as they descend thence, so as to be close together on entering the wood-block. On the top of the frame, D, there are a number of finger-levers, N, in two sets of four each, each set being arranged to vibrate on centres at one of the back corners of the frame, and passing across towards the opposite front corner. The two sets of finger-levers are arranged at slightly different levels, so as not to interfere with each other; and their front ends are bent and spread out, and formed with flat button-like terminations, to be easily acted upon by the fingers of the operator, who rests his hands upon the finger-plate, N', fixed upon the frame, D. Each finger-lever, N, clips one of the wires, K, by means of a small spring; and when any one of the finger-levers is depressed, it draws down the corresponding wire, K, in readiness to be inserted in the wood-block. A bent bar, C', which is fixed to the stationary guides, C, passes under the finger-wires, N, a little in front of the wires, K, and is so situated as, on the descent of the frame, D, to lift any of the finger-wires that may have been depressed. When this is being effected, the wires, K, are held firm to the face of the frame, D, and the clipping springs of the finger-wires, N, have not power to lift them, but slip over them when rising. The operator having his pattern before him, depresses such of the finger-levers, N, as correspond to the portion of the pattern upon which he is at the moment engaged, and thereby draws down such wires as have to be inserted into the wood-block, making them project below the level of the other wires if any are left undepressed. These projecting wires are then forced down into the wood by the descent of the frame, D, as actuated by the treadles, J, in the manner already described. The wires, K, are held firmly to the face of the frame, D, during its descent, by the action of a lever-claw, O, the two arms of which are held up by springs, P, fixed to the bracket, B. The claw turns in centre eyes on the face of the frame, D; and when this frame descends, the fixed springs cause the front of the claw to press upon a small plate, Q, in front of the wires, K. When the wire is entered into the wood-block, it is cut by a pair of clippers, consisting of a cutter, R, fixed to the under front edge of the frame, D, and a moveable cutter, S, turning in eyes on the face of the frame, and actuated by means of two arms, T, fixed to it, and passing back, so as to be acted upon by a cross-bar, U, bolted to the fixed guides, C. Hence, as the frame descends, the arms, T, come in contact with the cross-bar, U, and, being thereby lifted up, cause the cutter, S, to clip off the wire against the fixed cutter, R. When the wires, which have been entered into the wood by the depression of the frame, D, are cut off in the manner described, the frame, D, is raised again by the action of the treadle in readiness for a fresh stroke. The block of wood, L, is shifted between each descent of the frame, D, to bring a fresh portion of its surface under the wires, K. The block, L, is mounted upon a cast-iron plate, V, which is fixed upon a rectangular frame, W, by screws, X, at the four corners, these screws also serving as a means of adjusting the level of the plate. The frame, W, is planed truly on the under side of its front and back edges, which are of the cross section indicated in fig. 1, and fit upon transverse slides upon a frame, Y, upon which slides the frame, W, carrying the block, can move from side to side. At the back of the frame, W, is a small bar, Z, furnished with a row of horizontal pins projecting on both its inner and outer sides. This bar is connected by two side-pieces, sliding in grooves in the sides of the frame, W, to a horizontal bar, *a*, in front of the frame, by means of which bar, *a*, the operator can shift the bar, Z, to or from the back of the frame. The bar, Z, lies between the forks of an escapement-piece, *b*, to which a vertical movement is given at each transverse shift of the frame, W. This vertical movement of the escapement-piece, *b*, allows the bar, Z, to pass one tooth. When the frame, W, is going in one direction, the bar, Z, is pushed back, and is acted upon by the escapement on the back prong of the forked-piece, *b;* and when the frame is moving in the opposite direction, the bar, Z, is drawn forward, so as to be acted upon by the escapement on the front prong of the forked-piece, *b*. The escapement is of a similar description to that in use in several machines requiring such a contrivance. A pin of the rack presses against a fixed tooth on the face of the escapement, and when the escapement descends, a spring-tooth enters behind the next pin in the rack, whilst the other pin slips off the fixed tooth; and on the upward movement of the escapement, the next pin, which had been caught by the spring-tooth, is transferred to the fixed tooth, and holds the rack stationary until the succeeding movement of the escapement. The escapement-piece, *b*, is made to descend by means of a radial feather, *c*, on a horizontal spindle carried in bearings in the framing, the feather passing through a groove in the lower part of the piece, *b*, and being of sufficient length to suit the back and forward movement of the frame, W. A cord, or wire, *d*, is attached to the feather, *c*, so as to pull the latter down, this cord or wire being connected to a tongue jointed on the left foot treadle, J. On the pressure of the foot being applied, the tension of the cord, *d*, is prevented from drawing up the tongue too far, by means of a tail, which comes in contact with the treadle. The escapement-piece, *b*, is raised by the action of a spring after each descent. The frame, w, is moved transversely by means of a weight, *f*, the cord of which is wound upon a barrel fast on the horizontal shaft, *g*, carried in end-bearings in the front and back frame-pieces of the machine. The shaft, *g*, carries upon it a tubular boss, *h*, fitted to it with a groove and feather, but capable of sliding longitudinally upon it; and this boss has formed or fixed upon it a pinion, or star-wheel, *i*, on each side of which is a pulley, *j*, *k*, both loose upon the boss, *h*. Each of the pulleys, *j*, *k*, has a cord wound upon it, the cord from one pulley going direct to a point of attachment on the frame, w, so as to draw the frame in one direction, whilst the cord from the other pulley passes over a small guide-pulley, and thence to a point of attachment to the opposite end of the frame, w. Hence the frame will be drawn in either direction, accordingly as one or other of the pulleys, *j*, *k*, is put into gear. Each of these pulleys has one or more pins on its inner face, so as to gear with, and be driven by, the wheel, *i*, when in juxtaposition therewith. The pulleys, *j*, *k*, are kept constantly at an equal distance apart, and in the same position relatively to the frame, Y, by means of a bracket-piece bolted to the inside of that frame, and formed with projections which enter grooves in the enlarged bosses of the pulleys, *j*, *k*. The wheel, *i*, is shifted into gear with one or other of the pulleys, *j*, *k*, by a longitudinal movement of the boss, *h*, effected by a lever oscillating on a centre on the frame, Y, and actuated by the bar, Z, which last is itself shifted by hand, as already mentioned. By this means a single adjustment at once alters the direction of transverse movement of the frame, w, and puts into gear the proper escapement for regulating that movement. When the cord is all unwound from the driving barrel fast on the shaft, *g*, it is wound up by hand by means of the external pinions, *q*, *r*, the former being on the end of the shaft, *g*, and the latter on a stud-pin in a convenient position for the hand of the operator, who turns it by means of a handle fixed on its face. Inside of the star-wheel, *i*, is a spring and catch working into a ratchet-wheel fixed on the boss, *h*, so as to allow of the weight, *f*, being wound up in a manner similar to a common clock movement. If necessary, the transverse traverse of the frame, w, may be effected by depressing the tongue on the left foot treadle, which will lower the escapement, *b*, out of gear with the rack, and allow the frame, w, to be shifted forward to any required position. Thus, if the line of pattern upon which the operator is engaged, contains a blank space of considerable extent, he can disengage the escapement-gear, and shift the frame at once across such blank space.

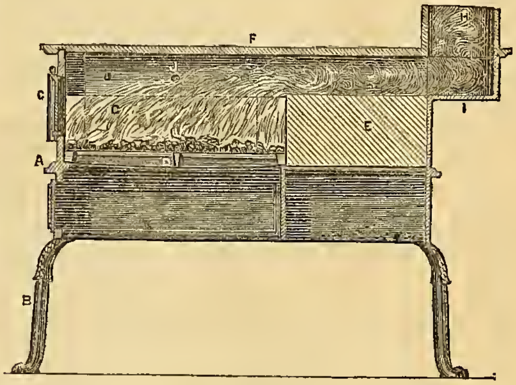
It remains now to describe the manner of effecting the back and forward movement of the wood-block, so as to bring different transverse lines thereof into the sphere of action of the depressing frame, D—the apparatus used for this purpose, and also that just described for effecting the transverse shift, being such as is also used in working out the other modifications of the invention. The frame, Y, upon which the frame, w, slides transversely, is fitted upon V slides, *s*, formed or fixed upon the upper edges of the side-frame pieces of the machine, and it is traversed back and forward upon these slides by means of a horizontal screw-shaft, *t*, carried in end-bearings in the framing, and working in a nut, *u*, fixed to or formed in the back traverse flange of the frame, Y. The screw-shaft, *t*, is turned by means of a weight, *v*, the cord from which is wound upon a pulley, *w*, upon the screw-shaft. Attached to the pulley, *w*, is a star-wheel, inside of which is a spring and catch in connection with a ratchet-wheel fixed on the screw-spindle, to allow the weight, *v*, to be wound up in a manner similar to the arrangement on the feather-shaft, *g*. The pulley is acted upon by a pinion working in gear with the star-wheel, and the spindle of the pinion passing through the front framing has a crank-handle fixed on it, to be acted upon by the operator when required. The front end of the screw-shaft projects through the frame, A, and has fixed upon it a ratchet-wheel, *x*, to which a lever detent is adapted to be worked by hand. This detent is formed with two catches just out of line with each other, and at a distance from each other equal to half the distance between two of the teeth of the ratchet-wheel, *x*. On shifting the lever, one catch passes off the face of the ratchet-tooth, whilst the other catch passes in front of the next ratchet-tooth, allowing the wheel to turn to the extent of half a tooth; a spring then shifts the detent back to its former position, when the wheel again turns to the extent of half a tooth, thus completing the shift of a tooth. The front end of the screw-shaft is formed with a squared termination to receive a handle, so that, on disengaging the detent from the ratchet, the frame, Y, may be speedily shifted into any required position. If it is a roller which is to be operated upon, instead of the block, L, the plate, V, is removed from the frame, W, and the roller is mounted in suitable bearings which are fixed upon the frame. A worm-wheel is fixed on the roller end or spindle, and this wheel is driven by a worm, the spindle of which may lie at any convenient angle. This spindle may be actuated by hand, or in any convenient manner, and it may carry a ratchet-wheel and detent similar to the ratchet-wheel and detent adapted to the screw-shaft, *t*. The longitudinal movement of the roller corresponds to the traverse movement of the frame, W, which remains as already hereinbefore described.

These systems may be adopted with advantage in printing patterns of many colours, as they will give much greater accuracy in "register" than that secured in the systems hitherto pursued; and the blocks or rollers for all the colours may be produced independently and simultaneously, with every certainty of their several impressions fitting into, and keeping register with each other.

LAUNDRY STOVE.

G. H. Nicoll, *Dundee.—Patent dated March* 28, 1855.

The laundress' occupation, which should be one of the cleanliest, is often deprived of this character in some of its details by the want of proper apparatus. Mr. Nicoll, in the present invention, endeavours to do away with one source of uncleanliness, by providing a stove for heating the implements used in what is technically termed the "getting up" of linen, this stove being really suited for the purpose for which it is intended, and whilst it performs its duty in a cleanly manner, doing so with certainty and uniformity, and with economy in the fuel used. Our engraving represents a vertical longitudinal section of one modification of the laundry stove, which is a neat rectangular cast-iron structure. or casing, A, supported upon legs, B, so as to have its upper part at a convenient level for the attendants. The cast-iron casing, A, is oblong, having a door, C, at one end for the introduction of fuel into the grate. The grate bars, D, extend back horizontally, just below the fire-door, somewhat more than half the length of the casing, and the remainder of the length of the casing is filled up with firebrick, E, to within a short distance of the top plate, F, of the casing. The sides of the casing at the front or grate end are lined with firebrick, as at G, to a height slightly less than that of the filling-up piece, E, behind. The smoke and gases pass off up a vent pipe, H, springing up from the back end, I, of the casing. The whole is covered with a flat horizontal plate, F, which is heated by the fire beneath, and serves to heat smoothing irons, or other utensils placed upon it. The sides of the casing are perforated above the firebrick lining of the grate space, as at J, for the introduction of Italian-iron bolts or other similar utensils; and when not in use, the holes through which the bolts are introduced, are closed by caps turning on pivots. Towards the back end of the stove, a door, K, is formed laterally in the casing for the introduction of the heaters of box smoothing-irons. These heaters are placed on the firebrick filling-up piece, E, towards the back of the stove, where they are rapidly heated to the required temperature. An ash-pan, L, is introduced beneath the grate, and is drawn out in front when the ashes require to be removed. The minor details of arrangement of the stove may obviously be variously modified; the main feature of the apparatus being the employment of a firebrick lining, which retains the heat and causes a considerable economy in fuel. The lateral openings for the Italian-iron bolts, and for the heaters of box irons, also obviate the necessity of opening the main fire-door, and thereby admitting a mass of cold air into the fire.



REVIEWS OF NEW BOOKS.

The Inventor.

This is the first number of an American monthly periodical, devoted to the interests of inventors—a numerous body in the United States.

We have no doubt that the exertions of its conductors will be duly appreciated by our relatives on that side of the water, where a good periodical of this kind seems much wanted. We hope it will be able to succeed without descending to the unworthy tricks which some members of the transatlantic press have recourse to—such as offering money prizes, or flattering persons in office.

CORRESPONDENCE.

A CONTRIBUTION TO THE HISTORY OF SCREW PROPULSION.

There has been a great deal said about doing something for Mr. F. P. Smith, as a return for his hitherto gratuitous exertions on behalf of the screw propeller; but there are others who—without wishing to detract from Mr. Smith's merits—must yet be heard in support of their claims in this matter, at a date much earlier than Mr. Smith's day. These men were too much in advance of their time, and hence they lost their fair share of credit as pioneers in this great movement.

I, for example, hold a silver medal, awarded to me in 1832, for a set of experiments which I made before the Royal Scottish Society of Arts in Edinburgh. With a boat 30 feet in length, and with trials extending over several hours, I showed an average rate of propulsion of ten miles per hour. The machinery was driven by two men, and the speed obtained was frequently up to 13 miles an hour.

I also made a set of experiments for the Highland Society in 1829; and, as early as 1826, I made a model of the *Glasgow* frigate from a large model in the possession of the Earl of Lauderdale, presented to the son of that nobleman, who was captain of the *Glasgow*. This model I first made for the purpose of showing the applicability of the screw to ships of war, and to boats for landing troops, as well as to regular sea-going vessels. This model is, or was, in the Highland Society's Museum, as I had to deposit it there that I might receive the handsome sum of £10, which was voted for the experiments made at Leith on a large boat. The model itself was really worth £20, being fitted up with clockwork, and having both side paddles and screws, to show the comparative advantage of the screw in rough water. The experiments cost me upwards of £20, so that with the model I expended more than £40, besides my own time; and all the return afforded me was the aforesaid sum of £10. Thus much for my early attempts to improve steam navigation. But the Royal Scottish Society of Arts behaved more handsomely; for they paid all the expenses, and presented me besides with the £5 silver medal before alluded to. They also sent my machinery up to Woolwich, with a recommendation to the Admiralty to make a trial of it on a boat, giving a detailed account of the experiments. Admiral Elliot was then at the head of the Admiralty; and he communicated with me, stating that they did not consider themselves justified in ordering a trial, considering the idea of steam propulsion for war vessels to be a mere chimera, or something to that effect. I recommended a single blade on each side of the centre, about one-twelfth of the circle, the blades being portions of a perfect screw. All that had been tried up to that time, as far as I was aware, were mere flat surfaces set at an angle. Mr. Weddell of Leith had a small boat fitted up in that way, and a small model also; but when his model was tried against mine, with the same strength of main driving spring, my boat ran twice as far as his before the spring ran out, the two runs being made in the same time, although my model was the larger of the two, and not of such fine lines as its rival.

I was conceited enough about all this; and not being able to discover that any one had used the real screw before my time, I piqued myself upon being the inventor of the screw propeller, until I saw my error on perusing the first part of the *Imperial Cyclopædia*. What I saw there proved to me, that Mr. Shorter (1799) had understood the matter quite as well as I did.

In some of my models, I placed the screw exactly in the same position as it generally occupies now. But the influx of water through the stuffing-box of the shaft gave me much trouble, and when tightened up my power was greatly reduced, so that in my last experiments I was induced to adopt the two sets as in Taylor's plan. I found this arrangement to be of great advantage, as I could get a much higher velocity of the boat without requiring to speed the screw above half the former rate. I had room for screws of twice the original diameter, and they were only immersed to somewhat less than half their diameter. There were only two blades, those of one screw being run into the centre of the other—that is, they worked into each other's recesses in passing round, and in reverse directions; being coupled inside with two spur-wheels of equal diameter, they retained their relative positions. But I found that, by cutting away about two-thirds from the centre, forming the blade into a sharp arm with the twist, they were driven considerably easier, and hence I obtained a higher speed; and even in making the blade narrower, I found an advantage. The screws sent to Woolwich were of this latter kind, and 3 feet in diameter. Such is a brief history of my propelling schemes.

Robert Wilson.

Low Moor Iron Works, Bradford, Oct., 1855.

DISTILLED WATER FOR MARINE BOILERS.

I have recently instituted experiments here upon marine engines, with the view of using fresh instead of salt water in the boilers, the water, of course, to be of a much higher temperature than sea-water. I thus avoid the objectionable incrustation of the boilers, and render blowing-off unnecessary, at the same time saving fuel, by returning to the boiler distilled water of a temperature as near 212° as possible.

The plan consists in connecting with the cylinders, of either high or low pressure engines, a copper pipe, a little larger in diameter than the steam supply pipe. This pipe is passed through the side of the ship, and attached externally beneath the water-line, passing round the bows or stern, and thence on the opposite side of the ship to re-enter and terminate in a reservoir. The reservoir has two compartments, one above the other, the lower compartment furnished with a ball-cock or float-valve. The lower compartment is quite tight, and has a small pipe inserted in the top, and passing through the upper compartment into the air, or into the chimney of the furnaces. By supplying the two compartments of the reservoir and the boilers with fresh water as opportunities offer, a circle of supply will be kept up.

This arrangement simplifies the machinery, and the engines will necessarily work with great ease. The condensing pipe, surrounded at all times when the ship is in motion by cold water, will create a continuous partial vacuum by continuous condensation, as good as any that can be formed. The external atmospheric pressure to be overcome will be only at the orifice of the small pipe leading out of the lower compartment of the reservoir, which will be greatly diminished if the pipe be entered into the chimney of the furnaces. At the orifice of the pipe, if it be left in the air, there will be the ordinary pressure, supposing the air not to be rarefied; but within the condensing pipe, and the lower compartment of the reservoir, it will be much diminished in force.

By this arrangement the steam will again become water, and fall into the lower compartment of the reservoir. Should not the whole be condensed, an escape is provided in the small pipe. When, by waste, the quantity of water in the lower compartment is diminished, the float-valve will supply more from the upper compartment of the reservoir. The upper compartment can be kept supplied in any ordinary manner. Should circumstances occasion it to be inconvenient to supply fresh water, salt water may be supplied, and little evil to the boilers would result, as this would be used over and over again in a circle. The boilers to be supplied from the lower compartment by a force-pump.

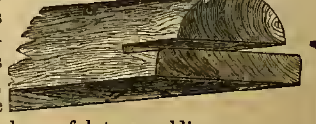
To avoid any bad effect upon the run of the ship, the condensing pipe should pass out of the side and in again with as little projection as possible. This will be desirable, whether circumstances require the pipe to be passed round the bow or the stern. If carried round the bow, it should pass through the cutwater; if round the stern, it should pass through the stern-post.

I have no drawings to illustrate my plans, and hope the description given clearly explains them.

Gosport, October, 1855. James Biden.

SIMPLE GUN-LOCK VICE.—DUPLEX-ACTION POST-OFFICE STAMPER.—TANDEM REAPING MACHINE.

My sketch annexed represents a contrivance which I originated the other day, as a substitute for a hand-vice in taking my gun-lock to pieces. It is simply a piece of ash wood, 3 inches long by $1\frac{1}{2}$ inches wide, and $\frac{7}{8}$ths thick. In the end of this block is a groove, cut by a handsaw to a depth of half an inch, and $\frac{3}{16}$ths wide. This groove receives the mainspring of the lock, just as a vice would. In applying it, the lock is drawn up to full cock, when the groove is entered over the spring, as in the separate detail. On the hammer being lowered, the spring fixes itself firmly in the embracing groove, and can then be withdrawn by the wood as a holder. The notion would be useful to a soldier on a campaign, or to a colonist in the backwoods.



In all the large towns, letters are stamped in the post-office with black ink, the stamping device being in the form of a figure 8, and performing two operations at once—the cancelling of the postage stamp, and the marking the name of the town. When this is generally adopted throughout the post-office service, it must effect a great saving to the country. Perhaps some of your readers can tell us who conceived the idea.

I lately saw a reaping machine, of Crosskill's manufacture, working most favourably at Conway. The horses were harnessed tandem-wise, a shaft horse and a leader—an arrangement greatly preferred to the pole, which had been discarded. It cut seven acres a-day with eight men and two pairs of horses, the latter working in spells of three hours. The machine had been worked two seasons, and its performance may be guessed from the fact, that the owner and user intends to have a second one of the same kind. The saw is what I call "shark-toothed;" each large semi-diamond tooth having smaller ones upon its two cutting edges.

C. Butler Clough.

Llwyn, Offa, Mold, October, 1855.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Glasgow, September, 1855.

We present this month the heads of all the papers read at this meeting, as a sheet of reference for the actual labours of the time. With these heads we can only give notices of one or two of the papers themselves. Next month we shall supply a more copious selection.

Section A.—Mathematical and Physical Science.

President—Rev. Prof. Kelland.

Prof. Powell,—Report on luminous meteors.

Sir David Brewster,—On the radiant spectrum.

J. P. Joule,—Account of experiments on the force of electro-magnates.

Prof. W. Thomson,—On the effect of mechanical strain on the thermo-electric qualities of metals; and On perisaltic induction of electric currents in submarine telegraph wires.

Rev. Dr. Scoresby,—Elucidations, by facts and experiments, of the magnetism of iron ships, and its changes.

E. O. W. Whitehouse, Esq.,—Experimental observations upon an electric cable.

Mr. Whitehouse said that he regarded it as an established fact, that the nautical and engineering difficulties which at first existed had been already overcome, and that the experience gained in submerging the shorter lengths had enabled the projectors to provide for all contingencies affecting the greater. The author then drew the attention of the Section to a series of experimental observations which he had recently made upon the Mediterranean and Newfoundland cables, before they sailed for their respective destinations. These cables contained an aggregate of 1,125 miles of insulated electric wire; and the experiments were conducted chiefly with reference to the problem of the practicability of establishing electric communications with India, Australia, and America. The results of all the experiments were recorded by a steel style upon electro-chemical paper by the action of the current itself, while the paper was at the same time divided into seconds and fractional parts of a second by the use of a pendulum. This mode of operating admits of great delicacy in the determination of the results, as the seconds can afterwards be divided into hundredths by the use of a "vernier," and the result read off with the same facility as a barometric observation. Enlarged facsimiles of the electric autographs, as the author calls them, were exhibited as diagrams, and the actual slips of electro-chemical paper were laid upon the table. The well-known effects of induction upon the current were accurately displayed; and contrasted with these were other autographs, showing the effect of forcibly discharging the wire, by giving it an adequate charge of the opposite electricity in the mode proposed by the author. No less than eight currents—four positive and four negative—were in this way transmitted in a single second of time through the same length of wire (1,125 miles), through which a single current required a second and a half to discharge itself *spontaneously* upon the paper. Having stated the precautions adopted to guard against error in the observations, the details of the experiments were then concisely given, including those for "velocity," which showed a much higher rate attainable by the magneto-electric than by the voltaic current. The author then recapitulated the facts, to which he specially invited attention:—First, the mode of testing velocity by the use of a voltaic current divided into two parts (a split current), one of which shall pass through a graduated resistance tube of distilled water, and a few feet only of wire, while the other part shall be sent through the long circuit, both being made to record themselves by adjacent styles upon the same slip of electro-chemical paper. Second, the use of magneto-electric "twin currents," synchronous in their origin, but wholly distinct in their metallic circuits, for the same purpose, whether they be made to record themselves direct upon the paper, or to actuate relays or receiving instruments which shall give contacts for a local printing battery. Third, the effects of induction, retardation of the current, and charging of the wire, as shown autographically; and contrasted with this—fourth, the rapid and forcible discharging of the wire by the use of an opposite current; and hence—fifth, the use of this as a means of maintaining, or restoring at pleasure, the electric equilibrium of the wire. Sixth, absolute neutralization of currents by too rapid reversal. Seventh, comparison of working speed attainable in a given length of wire by the use of repetitions of similar voltaic currents, as contrasted with alternating magneto-electric currents, and which, at the lowest estimate, seemed to be seven or eight to one in favour of the latter. Eighth, proof of the co-existence of several waves of electric force of opposite character in a wire of given length, of which each respectively will arrive at its destination without interference. Ninth, the velocity, or rather amount of retardation, greatly influenced by the energy of the current employed, other conditions remaining the same. Tenth, no adequate advantages obtained in a 300-mile length by doubling or trebling the mass of conducting metals. The author, in conclusion, stated his conviction that it appeared from these experiments, as well as from trials which he had made with an instrument of the simplest form, actuated by magneto-electric currents, that the working speed attainable in a submarine wire of 1,125 miles was ample for commercial success. And may we not, he added, fairly conclude also, that India, Australia, and America are accessible by telegraph without the use of wires larger than those commonly employed in submarine cables?

Prof. C. Piazzi Smyth,—Note on solar refraction.

Prof. Nichol,—Remarks on the chronology of the formations of the moon, with a notice concerning the great Breadalbane reflector in the Glasgow Observatory.

Prof. Stokes,—On the achromatism of a double object glass.

Prof. W. Thomson,—On the use of observations of terrestrial temperature for the investigation of absolute dates in geology.

Dr. Adamson,—On the fixing of photographs.

Antoine Claudet,—On the polystereopticon; a new instrument to exhibit stereoscopic pictures.

Dr. Green,—On a machine for polishing the specula of reflecting telescopes (illustrated by a working model).

A. J. Ellis,—On a more general theory of analytical geometry, including the Cartesian as a particular case.

James Thomson,—On certain curious motions observable on the surface of wine and other alcoholic liquors.

Sir David Brewster,—On the binocular vision of surfaces of different colours.

Professor Tyndall,—Experimental demonstration of the polarity of diamagnetic bodies.

Captain W. S. Jacob,—On certain anomalies presented by the binary star, 70 Ophiuchi.

Sir John Ross,—On the aurora borealis.

George Buist, LL.D.,—On hailstorms in India, from 1851 to 1855. Communicated by Colonel Sykes.

Astronomer Brown,—On the establishment of a magnetic and meteorological observatory on the mountain Angusteer Mullay, 6200 feet, in Travancore. Communicated by Colonel Sykes.

M. J. Johnson,—On the detection and measurement of atmospheric electricity by the photo-barograph and thermograph.

Matthew Collins,—On the possible and impossible case of quadratic duplicate equations.

Rev. Dr. Paterson,—On the cultivation of sand-hills.

Robert Russell,—On the meteorology of the United States and Canada.

Prof. C. Piazzi Smyth, — On naval anemometrical observations. Apparatus exhibited.

Prof. Connell,—Improvements on a dew-point hygrometer lately described by the author.

Captain Fitzroy,—Communication of new charts of wind movement on the surface of the globe, in accordance with the directions of the Board of Trade.

Dr. Nichol,—Notices of the climatological elements in the western district of Scotland.

Prof. Chevallier,—On a rainbow seen after sunset; and On the analogies between heat and lightning.

Consul Parker,—Notes on the Hindo-Chinese nations and Siamese rivers, with an account of Sir John Bowring's mission to Siam.

Captain Sherard Osborn,—Notes on the recent Arctic expeditions.

Sir Edward Belcher,—Remarks on the late Arctic expeditions, and on the several completions of the North-west passage, by the officers of the last expeditions (Collinson's, Belcher's).

James N. Ramsay,—Short account of an ascent of Mont Blanc, by a new route from the side of Italy.

Rev. Dr. Scoresby,—On certain erroneous principles as to magnetic phenomena, which have of late years been set forth and popularly received: and on iron ships.

Sir David Brewster,—On the triple spectrum.

M. Haidinger, Vienna,—On the single polarization of Cadmacctite.

Prof. Tyndall,—Comparison of magnetic induction and calorific conduction in crystalline bodies.

Arthur Cayley,—On the porism of the in-and-circumscribed triangle.

Prof. W. Thomson,—On electric properties of magnetized iron; On new instruments for measuring electric potentials and capacities; and On the thermo-electric position of aluminium.

Dr. Lee,—On fifty photographs of snow crystals of 1855.

Dr. Taylor,—On the nature and cause of waterspouts.

Sir William Rowan Hamilton,—On the conception of the anharmonic quaternion, and on its application to the theory of involution of space.

Sir David Brewster,—On the absorption of matter by the surfaces of bodies; On the remains of plants in calcareous spar; and Phenomena of decomposed glass.

Prof. C. P. Smyth,—On altitude observations at sea.

Dr. Lee,—On six photographs of Hartwell Observatory; and On a photograph of the Craig telescope at Wandsworth.
W. Symons,—On a new form of the gas battery.
John Thomas Towson,—On the means proposed by the Liverpool compass committee, for carrying out investigations relative to the laws which govern the deviation of the compass.
Negretti and Zambra,—On a new maximum thermometer.
Paul Cameron,—On the deviations of the compass in iron ships.
M. O. T. Nossotti,—On the calculation of an observed eclipse or occultation of a star.

Section B.—Chemical Science.

President—Dr. L. Playfair.

J. Galletley,—On a new glucocide contained in the petals of the wallflower.
Prof. Anderson,—On the action of acids and alkalies on colouring matters.
Prof. G. Wilson,—On the chemical changes undergone by artificial sea-water, after ten months' use in the marine vivarium.
Prof. Andrews,—On the polar decomposition of water by frictional and atmospheric electricity.
B. Stewart,—On certain laws observed in the mutual action of sulphuric acid and water.
Dr. Mathieson,—On the metals of the alkaline earths, with specimens.
Dr. Greville Williams,—On the basic constituents of coal naphtha.
Prof. Penny,—On the phosphorescence and composition of plate sulphate of potash.
Dr. Stevenson Macadam,—On the chemical constitution of the water of the Clyde.
Prof. Frankland,—On some organic compounds containing metals.
Prof. Anderson,—On the decomposition of the platinum salts of the organic alkalies.
Baron Liebig,—On a new form of cyanic acid.
M. Fremy,—On the extraction of metals from the ore of platinum.
Prof. Andrews,—On an allotropic modification of chlorine and bromine analogous to the ozone from oxygen.
Prof. Bunsen (of Heidelberg), and Dr. H. E. Roscoe (of London),—On photochemical researches, with particular reference to the laws of the chemical action of light.
Prof. Ramsay,—On a process for obtaining lithographs by photographic process.

Professor Ramsay described a process by which Mr. Robert M'Pherson, of Rome, had succeeded in obtaining beautiful photo-lithographs, specimens of which had been hung up in the Photographic Exhibition in Buchanan Street. The steps of the process are as follow:—1. Bitumen is dissolved in sulphuric acid, and the solution is poured on an ordinary lithographic stone. The ether quickly evaporates, and leaves a thin coating of bitumen spread uniformly over the stone. This coating is sensitive to light, a discovery made originally by Mr. Niepce, of Chalons. 2. A negative on glass, or waxed paper, is applied to the sensitive coating of bitumen, and exposed to the full rays of the sun for a period longer or shorter according to the intensity of the light, and a faint impression on the bitumen is thus obtained. 3. The stone is now placed in a bath of sulphuric ether, which almost instantaneously dissolves the bitumen, which has not been acted upon by light, leaving a delicate picture on the stone, composed of bitumen on which the light has fallen. 4. The stone, after being carefully washed, may be at once placed in the hands of the lithographer, who is to treat it in the ordinary manner with gum and acid, after which proofs may be thrown off by the usual process.—Professor Ramsay then proceeded to state that the above process, modified, had been employed with success to etch plates of steel or copper, without the use of the burin:—1. The metal plate is prepared with a coating of bitumen, precisely in the manner noticed above. 2. A positive picture on glass or paper is then applied to the bitumen, and an impression is obtained by exposure to light. 3. The plate is placed in a bath of ether, and the bitumen not acted upon by light is dissolved out. A beautiful negative remains on the plate. 4. The plate is now to be plunged into a galvanoplastic bath, and gilded. The gold adheres to the bare metal that refuses to attach itself to the bitumen. 5. The bitumen is now removed entirely by the action of spirits and gentle heat. The lines of the negative picture are now represented in the bare steel or copper, the rest of the plate being covered by a coating of gold. 6. Nitric acid is now applied as in the common etching process. The acid attacks the lines of the picture formed by the bare metal, but will not bite into the gilded surface. A perfect etching is thus obtained.

Mr. Barnet,—On photographic researches.
Mrs. A. Crosse,—On the apparent mechanical action accompanying electrical transfer.
Prof. G. Wilson,—On the proofs of the existence of haloid salts in solution.
Dr. Daubeny,—Extracts from a letter from the Rev. A. Farrar, of Queen's College, Oxford, on the late eruption of Vesuvius.
Prof. F. C. Calvert,—On alloys of iron and aluminium; and On the action of sulphuretted hydrogen on the salts of zinc and copper.
J. B. Edwards,—On the titaniferous iron of the Mersey shore.
Dr. T. Rowney,—On two mineral substances employed as pigments; and On the composition of Vandyke brown.
D. Forbes,—On the action of sulphurets on metallic silicates at high temperatures.
J. B. Lawes and Dr. Gilbert,—On some points connected with agricultural chemistry.
Dr. Gladstone,—Report on the influence of the solar radiations on the growth of plants, under different atmospheric conditions.
Dr. Hassall,—On the chemistry of the adulteration of food.
Prof. Du Lanza,—Observations on the polarizing property of the new crystals of Cadmacetite.
M. Peligot,—On the composition of air dissolved in ordinary water.
Prof. Anderson,—Report on the progress of the chemical manufactures of Glasgow.
Prof. Frankland,—On a mode of conserving the alkaline sulphates contained in alums.
Prof. F. C. Calvert,—On the formation of a new lustre on fabrics by the production of metallic sulphurets on their surfaces.
Dr. A. Lauder Lindsay,—On the commercial uses of lichens.
G. F. Wilson,—On a new process for obtaining and purifying glycerine, and on some of its applications.
Prof. F. C. Calvert,—On the manufacture of iron by purified coke.
W. Wallace,—On the manufacture of red prussiate of potash.
Dr. Maclagan,—On the composition of bread.
Prof. Völcker,—On caseine, and a method of determining sulphur and phosphorus in organic compounds, in one operation.
John Horsley,—On a new mode of determining the adulteration of coffee with chicory.
Dr. R. D. Thomson,—On the condition of the atmosphere during cholera.
Chevalier de Claussen,—On the preservation of the potato crop.
R. Galloway,—On the quality of food of artizans in an artificially heated atmosphere.
Peter Spence,—Some information on the deposits of nitrate of soda in South America, and the mode of its extraction.
Dr. M'Vicar,—On the probability of representing by diagrams the principal functions of the molecules of bodies.
Walter Crum,—On some new salts of alumina.
Prof. Anderson,—On a new wax from Java.
Dr. Gladstone,—On a crystalline deposit of gypsum in the reservoir of the Highgate waterworks.
Peter Spence,—On the coal consumption of our large towns,—its present and prospective conditions economically, and as affecting the sanitary state of the atmosphere; with a proposed remedy for the evils resulting therefrom.
Sir E. Belcher,—On some experience in Arctic dietaries.
Samuel Highley,—Crystallogenesis, and the equivalent in the mineral kingdom corresponding to geographical distribution in the animal and vegetable kingdoms.
Dr. F. Penny,—On the manufacture of iodine and other products from kelp; and Notice of a simple method for the valuation of cochineal.
John Horsley,—On a new method of testing for, and manufacturing iodine.
Dugald Campbell,—Description of Dr. Clark's patent process for softening water, now at use at the works of the Plumstead, Woolwich, and Charlton Consumer's Pure Water Company, together with some account of their works.
R. Warrington,—On the occurrence of oxychloride and red oxide of mercury in certain specimens of the Hydrargyrum cum crætâ.
Dr. Normandy,—On the production of fresh water from sea water.
Edward Hæffley,—Experiments on the compounds of tin with arsenic.
C. Nicholson and Dr. D. Price,—On the chemical compounds of some iron ores called "brass," occurring in the coal measures of South Wales.
R. Galloway,—On the use of phosphate of potash in a salt-meat dietary.
Dr. A. Fyfe,—On the products of the destructive distillation of cannel coals.

Section C.—Geology.

President—Sir R. J. Murchison.

Hugh Miller,—On the less known fossil floras of Scotland.
Prof. Harkness,—On the lowest sedimentary rocks of Scotland; and On the geology of the Dingle promontory, Ireland.
James Bryce,—On the glacial phenomena of the lake district of England.
John Buchanan,—On ancient canoes found at Glasgow.
W. Darling,—On the probable maximum depth of the ocean.
J. W. Dawson,—On the fossils of the coal formation of Nova Scotia.
R. Slimond,—On new forms of Crustacea from the district of Lesmahagow.
Sir Roderick I. Murchison and Professor James Nicol,—New geological map of Europe exhibited.
Capt. Sir E. Belcher,—Notice of the discovery of ichthyosaurus and other fossils in the Northern Expeditions.
H. C. Sorby,—On some of the general mechanical structures of limestone.
Evan Hopkins,—On the meridional and symmetrical structure of the globe—its superficial changes, and the polarity of all terrestrial operations.
Robert Allan,—On the present condition of the geysers of Iceland.
Evan Hopkins,—On the gold-bearing districts of the world.
J. A. Campbell,—On the auriferous quartz formation of Australia.
John Price,—On the geology of the district of Great and Little Ormeshead, North Wales.
H. C. Sorby,—On the structure and mutual relations of the older rocks of the Highland border.
Prof. Harkness and Blyth,—Remarks on the cleavage of the Devonians of the south of Ireland.
Prof. Rogers,—On some reptilian foot-prints from the carboniferous strata of Pennsylvania.
D. Page,—On the subdivisions of the palæozoic and metamorphic rocks of Scotland; and On the stratigraphical relations and development of the fresh-water, or lower carboniferous limestone of Dr. Hibbert.
Sir R. I. Murchison,—On the relations of the crystalline rocks of the North Highlands to the old red sandstone of that region, and on the recent discoveries of fossils by Mr. Charles Peach; and exhibition of fossil plants of the old red sandstone of Caithness. Collected by Mr. John Miller of Thurso.

J. W. Salter,—On the discovery of organic remains in the rocks of the Longmynd, Shropshire, the Cambrian of the geological survey. Communicated by Sir R. I. Murchison.

Richard Banks,—On the recent discovery of Ichthyolites and Crustacea in the tilestones of Kingston, Herefordshire. Communicated by the President.

Rev. W. R. Symmonds,—On a phyllopod crustacean in the upper Ludlow rock of Ludlow. Discovered by H. Lightbody, Esq.

H. C. Sorby,—On the currents produced by the action of the winds and tides, and the structure generated in the deposits formed thereby, which enable us to determine the physical geography of the seas at the various geological epochs.

Prof. Rogers,—On some of the geological functions of the winds, illustrating the origin of salt, &c.

James Smith,—On the shelly deposits of the basin of the Clyde, with proofs of change of climate.

Robert Chambers,—On denudation and other effects usually attributed to water.

Charles M'Laren,—On the excavation of certain river channels of Scotland.

Prof. Jas. Nicol,—On striated rocks, and other evidences of ice action observed in the north of Scotland.

Andrew C. Ramsay,—On the commencement and progress of the geological survey of Great Britain, in Scotland.

James Bryce,—On a lately discovered tract of granite in Arran; and on the relative ages of the various granites and other igneous products in that island.

Prof. Philips,—Remarks on certain trap dikes in Arran.

Alexander Bryson,—On sections of fossils from the coal formation of Midlothian.

Prof. Wyville Thomson,—On the fauna of the lower Silurians of the south of Scotland.

D. Forbes,—On the relations of the Silurian and metamorphic rocks of the south of Norway.

Dr. Lanza,—On the formations of Dalmatia, and some new radiolites and hippurites from the chalk. Communicated by J. W. Woodall.

J. W. Salter,—Some additions to the geology of the Arctic regions.

D. Page,—On the pterygotus and pterygotus beds of Great Britain.

J. F. Bateman,—Report on the present state of our knowledge of the supply of water to towns.

H. D. Rogers,—On some features in the geology of the United States. Illustrated by a new geological map.

Note on a recent geological survey of the region between Constantinople and Broussa, in Asia Minor, in search of coal, by Mr. H. Poole. Communicated by Sir R. I. Murchison, with the permission of the Earl of Clarendon.

George Anderson,—On the superficial deposits laid open by the cuttings on the Inverness and Nairn Railroad.

Searles V. Wood,—On the probable maximum depth of the ocean.

Section D.—Zoology and Botany, including Physiology.

President—Rev. Dr. Fleming.

Dr. Dickie,—On the effects of last winter upon vegetation at Aberdeen.

Mr. Dawson,—On the species of Meriones and Arvicolæ found in Nova Scotia.

Prof. Henslow,—Report on typical forms for museums.

R. Patterson,—Exhibition of a series of zoological diagrams, prepared for the department of Science and Art, Marlborough House.

E. J. Lowe, —On a singular mortality among the swallow tribe.

Mr. Fulton,—On the application of the principles of ward-case cultivation to agriculture.

Dr. Duncan,—On the impregnation of phanerogamous plants.

Dr. Spencer Cobbold,—Description of a new trematode infesting the giraffe; and Description of a malformed trout.

Andrew Murray,—Report on the recent additions to our knowledge of the zoology of the West Coast of Africa; and Abstract of the natural history of a recent voyage up the river Tchadda, by Dr. W. B. Baikie.

J. Baker,—On the geological distribution of plants.

Dr. Dickie,—Notes on the homologies of Lepismidæ.

Spence Bate,—Report on the British amphipodous Crustacea.

R. Patterson,—Report of the Belfast Dredging Committee.

M. Nachet,—On new forms of microscope, adapted for physiological demonstration.

N. B. Ward,—On Vivaria.

Rev. C. P. Miles, M.D.,—Some remarks on the Fauna of the Clyde, and on the Vivaria now exhibited in the City Hall.

Lucas Barrett,—Notes on the Brachiopoda observed in a dredging tour with Mr. M'Andrew on the coast of Norway, in the summer of the present year, 1855.

Mr. M'Andrew,—Exhibition of Zoophytes, Molluscs, &c., observed on the coast of Norway.

Mr. Ladd,—Exhibition of forms of microscope.

R. Warrington,—On the habits of the Stickleback; and On the effects of an excess or want of heat and light on the Aquarium.

J. Price,—Notes on animals.

Dr. Carpenter,—On the occurrence of the Pentacrinoid Larva of Comatula rosacea in Lamlash Bay; and On the structure and development of Orbitolites complanatus.

Chevalier de Claussen,—On Papyrus, Bonapartea, and other plants which can furnish fibres for paper pulp, &c.; On Haocornea speciosa, and artificial gutta percha and india-rubber; On the employment of Algæ and other plants in the manufacture of soap; and On the preservation of the potato crop.

Hugh Miller,—On the fossil flora of Scotland.

Sir William Jardine,—On the coregoni of Scotland.

Edmund Ashworth,—Remarks on the artificial propagation of salmon, and some account of the experiments at Stormont, near Perth.

Prof. Kölliker,—Exhibition of some rare fishes from Messina; and a new parasitic crustacean, named by him Lophura; and On the structure of some rare fishes from Messina—Helmichthys and Leptocephalus.

Prof. Daubeny,—On the action of light upon the germination of seeds; and Report on the vitality of seeds.

Sir Edward Belcher,—Remarks on the trunk of a tree growing in the Arctic circle.

Prof. Balfour,—Exhibition of a series of specimens illustrating the distribution of plants in Britain; and Remarks on the Alpine flora of Scotland.

Dr. Lankester,—Report on the registration of periodic phenomena; and Communication from Dr. Redfern on chemical products of Torbane Hill mineral.

P. Clark,—On the flowering of Victoria Regia in the Royal Botanic Gardens, Glasgow.

Dr. Lankester,—Exhibition of representations of natural history objects by photography; and Exhibition of a collection of Portuguese ferns, made by Mr. Furlong.

John Baker, Thirsk,—On the genus Galium.

Dr. Michelsen,—On the flowers and vegetation of the Crimea.

Prof. Macdonald,—On zoological classification.

Physiological Sub-section.

Chairman—Professor A. Thomson.

Prof. J. H. Bennett,—On the law of molecular elaboration in organized bodies.

Prof. Retzius,—On the hand of the Paraguayan man; and On the pelvis of a giant girl.

Prof. Kölliker,—On the male of the Argonaut; and On the physiology of the Spermatozoa.

Prof. Allen Thomson,—Observation on Spermatozoa.

Prof. Allman.—On the signification of the so-called ova in the Hippocrepian Polyzoa.

Dr. Ransom,—On the structure of the ova of fishes and other vertebrate animals.

Prof. Allen Thomson,—On the ova of Ascaris mystax.

Dr. Henry Nelson,—On the same subject.

Rev. W. Leitch,—On the development of sex in insects.

Dr. W. Camps,—On an abnormal condition of the nervous system.

Dr. Fowler,—An attempt to solve some of the difficulties of the Berkleyan controversy.

Dr. John Struthers,—On the explanation of the crossed influence of the brain.

Prof. Retzius,—On the fornix of the brain in man and animals.

Prof. Allen Thomson,—On the brain of the Troglodytes niger.

Dr. John Struthers,—On the use of the round ligament of the femur.

Dr. M'Cormac,—A short demonstration of the origin of tubercular consumption.

Prof. Retzius,—On the antrum pylori and antrum duodeni.

Dr. T. Spencer Cobhold,—On a pouch-like structure in connection with the ileo-colic valve of the giraffe.

Prof. Kölliker,—On the structure of the epithelium of the intestine, and on absorption; and On the occurrence of leucine in the pancreatic juice and contents of the intestine.

Dr. Ferdinand Cohn,—On the sexuality of the Algæ.

Dr. Roth,—On the application of physiological principles to gymnastic education.

James Macdonald exhibited and described an Andrometer, showing the relation of form, size, and strength of the human body.

Prof. Macdonald,—On the vertebral homologies.

Prof. Allen Thomson showed and described some malformations.

Prof. Retzius,—On brain of the Diomedea exulans, or albatross.

Prof. Sundewald,—On the homologies of the muscles of the limbs in birds.

Section E.—Geography and Ethnology.

President—Sir John Richardson.

Dr. W. Balfour Baikie,—Report of the late expedition up the Niger and Chadda Rivers.

Richard Cull,—On some water-colour portraits of natives of Van Diemen's Land.

Dr. Barth,—Description of Timbuctû, its population, commerce, &c. Communicated through the Foreign Office.

George Frere,—Despatch to the Earl of Clarendon, relating to Mr. C. J. Anderson's journey to Lake Ngami.

C. J. Anderson,—Late explorations in Africa.

Rev. Francis Fleming,—Journey across the rivers of British Kaffraria.

J. B. Davies,—On the skulls of the ancient Romans.

Rev. John Gemmel,—On the deciphering of inscriptions on two seals found by Mr. Layard at Koyunjik.

Dr. Julius Oppert,—On the geographical and historical results of the French Scientific Expedition to Babylon.

Prof. Retzius,—On Celtic, Sclavic, and Aztec Crania.

Col. Sykes,—On the survey of the Himalaya mountains, by Messrs. Schlagintweit.

Sir B. F. Outram,—Hartlepool pier and port as a harbour of refuge.

Lieut. Burton,—An account of a visit to Medina from Suez, by way of Jambo.

Joseph Boult,—On the importance of periodical engineering surveys of tidal harbours, illustrated by a comparison of the surveys of the river Mersey, by the late Francis Giles, C.E., and the marine surveys of the port.

The Earl of Harrowby,—Report of the Mersey Inquiry Committee.

Thomas Wright,—On the ethnology of England at the extinction of the Roman Government in the island; and On inscriptions in unknown characters on Roman pottery discovered in England.

Charles Roach Smith,—Remarks on a Roman sepulchral inscription, found in a Saxon vase in the Faussett collection.

Consul Brand,—Notes on the Portuguese possessions of S. W. Africa.

Rev. Dr. Livingston,—Extracts from letters dated Pungo, Andongo, and St. Paul de Loanda, describing his journey across Tropical Africa. Communicated by Sir R. I. Murchison, F.R.S.

A. Poey,—Hurricanes in the West Indies and the North Atlantic, from 1493 to 1855.

John Crawfurd,—On the different centres of civilization.

J. M. Inskip,—An account of the exploration of the Isthmus of Darien, under Captain Prevost, R.N.

Captain Robertson's ascent of the mountain Suméru Parbut, situated at the source of the Jumna.

Richard Cull,—On the complexion and hair of the ancient Egyptians.

Senor Susini,—The Amazon and the Atlantic water-courses of South America.

G. Edmonds,—On a philosophic universal language.

A. J. Ellis,—On a new universal alphabet, composed of ordinary types, for the use of ethnologists.

James Gall,—On improved monographic projections of the world, with illustrative maps and diagrams.

Prof. Macdonald,—On the pre-adamitic condition of the globe.

Rev. Thomas C. Archer,—On some peculiar circumstances connected with one of the coins used on the West Coast of Africa, having an ethnological bearing.

Richard Cull,—On the manual of ethnology and the ethnology of Samoa.

SECTION F.—STATISTICS.

President—R. MONCKTON MILNES.

Prof. Hussey Walsh,—On the condition of the labouring population of Jamaica, as connected with the present state of landed property in that island.

William Newmarch,—On the emigration of the last ten years from the United Kingdom, and from France and Germany.

Prof. A. Buchanan, M.D.,—On the physiological law of mortality, and on certain deviations from it, observed about the commencement of adult life.

John Strang, LL.D.,—On the progress, extent, and value of the coal and iron trades in the West of Scotland.

John Glyde, jun.,—On the localities of crime in Suffolk.

The Rev. A. K. M'Callum,—On juvenile delinquency, its causes and cure.

James M'Clelland,—On measures relating to the adoption of the foundry and agricultural system for the reformation of criminal and destitute children.

William Newmarch,—Remarks on two lectures delivered at Oxford in Trinity Term, by the Professor of Political Economy, on the subject of a recent paper by Mr. Newmarch, on the "Loans raised by Mr. Pitt, 1793–1801."

Prof. Hussey Walsh,—On the price of silver of late years, affording no correct measure of the general value of gold.

John Yeats,—On our national strength, tested by the numbers, the ages, and the industrial qualifications of the people.

Prof. A. Buchanan, M.D.,—On a mechanical method whereby a life table commencing at birth, may be converted into a table exactly similar commencing at any other period of life.

J. W. Gilbart,—On the laws of the currency in Scotland.

Count David Frölich,—An analysis of some of the principles which regulate the effects of a convertible paper currency.

William A. Guy,—On the fluctuations in the number of births, deaths, and marriages, and in the number of deaths from special causes in the metropolis during the last fifteen years—1840–54.

John Stark,—Return of the number of civil actions and civil and criminal prosecutions and informations in the northern circuit of Newfoundland, during 29 years—1826–55.

Richard Valpy,—On the effect of the war on the principal articles of Russian produce.

John Coldstream,—On some of the results deducible from the report on the statistics of disease in Ireland, published along with the census of 1851.

Sir Charles W. Pasley,—On a plan for simplifying and improving the measures, weights, and money of this country, without materially altering the present standards.

Theodore W. Rathbone,—On decimal accounts and coinage.

P. Gale,—On an easy and practical method for a decimal arrangement of our land measures, in connection with the Ordnance survey of Scotland.

P. L. Simmonds,—On the growth and commercial progress of California and Australia.

William Pare,—Some account of the "Equitable Villages" now formed and forming in the United States of North America, with a sketch of the principles upon which they are founded.

John Locke,—On the agricultural labourers of England and Wales, their inferiority in the social scale, and the means of effecting their improvement.

W. P. Alison, M.D.,—Notes on the application of statistics to several questions in medical science, particularly as to the external causes of disease.

A. G. Malcolm, M.D.,—On the influence of factory life on the health of the operative, as founded on the medical statistics of this class at Belfast.

David Stow,—On moral training schools for large towns.

Andrew Tennent,—Statistics of a grammar school class of 115 boys.

P. L. Simmonds,—Statistics of newspapers of various countries.

Robert Clarke,—On the prevailing diseases in the colony of Sierra Leone.

Lady Bentham,—On an improved mode of keeping accounts in our national establishments.

John Reid,—On the progressive rates of mortality as occurring in all ages; and on certain deviations.

SECTION G.—MECHANICAL SCIENCE.

President—W. J. M. RANKINE.

William Fairbairn,—Provisional report on the strength of iron plates; and provisional report on boiler explosions.

W. J. M. Rankine,—On practical tables of the pressure and latent heat of vapours.

Prof. Smyth,—On the transmission of time signals.

James Thomson,—On practical details of the measurement of running water by weir boards.

The Earl of Harrowby,—Report of Inventor's Funds and Patent Laws Committee.

W. J. Macquorn Rankine,—On the operation of the Patent Laws.

W. Bridges Adams,—On artillery and projectiles.

George Rennie,—On the effects of screw propellers when moved at different velocities and depths.

James Thomson,—On an india-rubber valve for drainage into tidal outfalls.

William Gorman,—On a momentum engine for steam or water; and On a water meter.

William Fairbairn,—On the Machinery of the Universal Exhibition at Paris.

First Report of the Liverpool Compass Committee, on the deviations of the needle in iron and other vessels, occasioned by inductive or polar magnetism, by J. B. Yates, F.A.S., chairman to the Compass Committee, and John Grantham, C.E., honorary secretary.

Andrew Henderson,—Report of Committee on Life Boats.

Thomas Dobson,—On the relation between revolving storms and explosions in coal mines.

James R. Napier,—Description of an expeditious method of drying timber.

Report of Committee on the friction of discs in water and on centrifugal pumps.

Henry P. Babbage,—On mechanical notation as exemplified in the Swedish calculating machine of Messrs. Scheutz.

James R. Napier,—Description of the launch of the steamer *Persia*; and On a simple boat-plug.

William Bridges Adams,—On railways and their varieties.

John Taylor, M.D.,—An account of experiments on combustion in furnaces, with a view to the prevention of smoke.

George Mills,—On manœuvring steamers.

William Sim,—On blasting rocks.

James Thomson,—On a windmill and centrifugal pump erected for drainage and irrigation; and On the friction break dynamometer

J. F. Ure,—On the navigation of the Clyde.

Andrew Henderson,—On the measurement of ships.

Robert William Billings,—On the mechanical principles of ancient tracery.

Herbert Mackworth,—Description of the metra.

Robert Barclay,—On an instrument for sounding.

Lady Bentham,—On continuous work in dockyards.

Robert Jamieson,—On a compass free from local attraction.

James Gall, jun.,—On the mutual influence of capillary attraction and motion on projectiles; and its application to the construction of a new kind of rifle shells and balls, to be thrown from common guns.

Prof. Macdonald,—On the structure of shell mortars without touch-hole, to be discharged by galvanic circuit.

Moses Holden,—On working a steam engine with rarefied air.

Dr. March,—On a screw vent for turning spiked guns into use.

Robert Mair,—On an application of galvanic power to machinery.

INSTITUTION OF MECHANICAL ENGINEERS.

JULY 25, 1855.

"On the Commercial Economy of working Steam expansively in Marine Engines," by Mr. E. E. Allen, London.

"On an improved Tuyere and Smith's Hearth," by Mr. C. Beyer, Manchester.

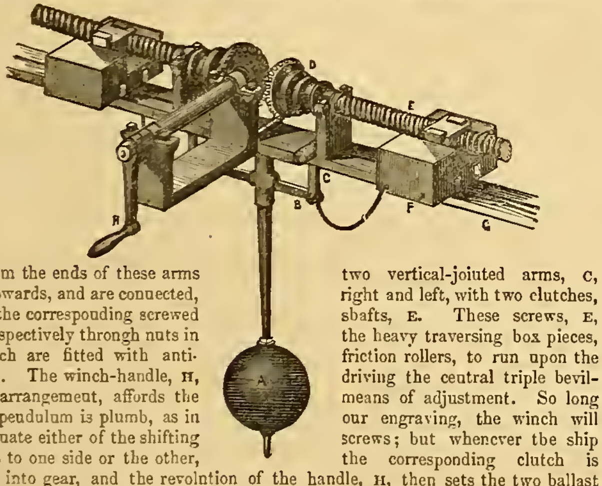
"On an improved Pressure Guage for Steam and Water," by Mr. John E. Cleft, Birmingham.

"On an Equatorial Motion for Telescopes," by Mr. T. Richards, Birmingham.

MONTHLY NOTES.

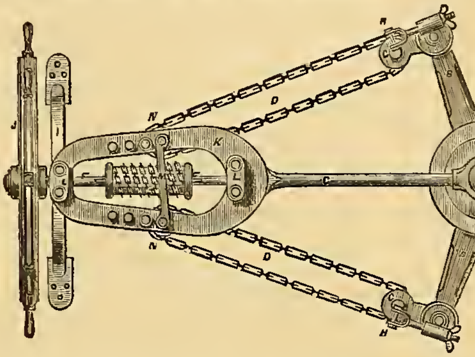
THE FARMER'S MECHANICAL AIDS.—At the Kirkby-Lonsdale meeting of the Lonsdale Agricultural Society, held during the past month, the impromptu chairman, Mr. Saunders of Wennington Hall, lectured the farmers of the district upon the folly of seeking aid at the hands of the mechanical engineer. He said:—With regard to the farms, that was a delicate subject to touch upon; but he must say that when gentlemen standing in the position in which he stood, came to them and urged upon them high farming, and the use of scientific implements, they talked a great deal of stuff. What he desired to impress upon the farmers was, the necessity of ploughing deep, and putting in plenty of manure; but he would never be a party to advise the tenant farmer to spend money in following out every new whim that rose up, and in trying every new patent. He knew something of these patents; and if they would bear with him a minute or two, he would tell them something about them. Some time ago he had gone over the farm of one of those gentlemen who was celebrated for his high farming, and whose name was quoted with approbation at the Lancaster meeting. It was not for him to dispute on such an occasion, and he listened with deference to what was said, but he would tell them a remarkable fact. While looking over the farm with his bailiff, a hard-headed Westmorland man like many of themselves, and who was, he believed, present in the room, and would enter into any explanation that his neighbours might ask for, he directed him, while he himself went round and listened to the fine tales that were told, to endeavour to ascertain the value of these implements. Well, he soon spied out a shed, which went by the name of the 'condemned shed,' which was full of costly implements lying altogether useless. That gentleman had, of course, every right to throw away his money as he liked, but he would never recommend them to be such fools as to spend their money in that fashion. If they attended to what he had said about the draining of their land, its ploughing and manuring, they might laugh at all these implements. He was glad to see gentlemen get these implements, but he would not recommend the tenant farmer to make any experiment with them, until their usefulness was fully proved.—It is something new, and we hope original, to find counsel of this sort given by a man of some local position to the congregated farmers of a forward and aspiring agricultural district. What, it may be asked, is it which has helped forward modern agriculture more than anything else, in the very times in which Mr. Saunders finds himself flourishing? It is the applied science of mechanics. More than this, we all know that the tenant farmers are the real introducers of agricultural machinery. If they waited for the example of those whom the not very discriminating speaker on this occasion termed "gentlemen," in contradistinction to tenant farmers, we should feel little of the smiling progress now everywhere greeting us. Mere pleasure farmers, who prefer this way of spending their money—and it is not a bad way either—do not usually learn much worth bestowal upon the tenant farmer. Mature judgment is too often wanting in their selection of mechanical contrivances; but if we wished to give the tenant, and consequently practical man, a good lesson on this subject, we should desire no better school-room than Mr. Saunders' 'condemned shed,' and no better educational models than the 'costly implements lying altogether useless.' Failures are at least as telling as successes; and they certainly have their weight in leading the observer to distinguish between difficulties and impossibilities. Men who aspire to fill positions above their fellows, should enjoin their humbler fellow-labourers to hope all things not impossible, and to believe all things not unreasonable. The farmer requires some urging on to the trial of mechanical expedients. He is not generally sufficiently ardent to call for the restraining influences, such as we have quoted, for his self-interest is strong enough for that purpose; and he will not rush into unheard-of schemes to his own ruin. For his own sake he ought to give some consideration to every mechanical novelty coming before him. If he does this, he will be safe—neither ruining himself by a lavish expenditure upon showy but imperfect apparatus, nor falling behind in that race of improvement which puts every one upon his mettle, remembering that he who hazards nothing on the cast, gains nothing, let the die turn as it may.

Ballast Trimming for Steamers.—Our annexed sketch represents an American contrivance for adjusting the trim of steamers in a most complete manner. A heavy pendulum weight, A, is suspended by a joint from a traversing frame, disposed on the under side of the deck, so as to have free vibration as the vessel careens. Cross arms, B, are jointed to the upper end of the pendulum rod; and from the ends of these arms two vertical-jointed arms, C, pass upwards, and are connected, right and left, with two clutches, D, on the corresponding screwed shafts, E. These screws, E, pass respectively through nuts in the heavy traversing box pieces, F, which are fitted with anti-friction rollers, to run upon the rails, G. The winch-handle, H, driving the central triple bevil-wheel arrangement, affords the means of adjustment. So long as the pendulum is plumb, as in our engraving, the winch will not actuate either of the shifting screws; but whenever the ship careens to one side or the other, the corresponding clutch is thrown into gear, and the revolution of the handle, H, then sets the two ballast boxes, F, as is required. Thus, if the shaft of the central intermediate pinion is made to rotate continuously by the action of the engine, a self-acting adjustment is obtained. Instead of the shifting screws, Messrs. Sedgwick, the inventors, contemplate the use of an endless chain, attached to a winding barrel on the shaft of the intermediate pinion, the chain being passed along beneath the deck to the starboard and port sides of the ship, and thence round guide pulleys, and over the deck. The portion of the chain above deck is connected to a pair of ballast chests, running on wheels, set upon transverse deck rails. In this arrangement the cross shaft, carrying the two external bevil wheels, is the driver, the pendulum action being contrived for putting the wheels in and out of gear, as in the former instance.



London Gas.—Dr. Letheby's last quarterly report to the Commissioners of Sewers on the gas supplied by the Great Central Gas Consumer's Company is a very favourable one. During the last quarter the average illuminating power of the gas has been equal to that of 13·31 sperm candles, or 15·24 wax, each consuming 120 grains of combustible matter per hour; in other words, five cubic feet of the gas have been equal in illuminating power to 1,597·2 grains of spermaceti, or 1,828·8 of wax; that is, to a little more than four ounces of wax candles. This result shows that the illuminating power of the gas has been very satisfactory, inasmuch as it has been about 27 per cent. greater than is required by the act of parliament. The chemical quality of the gas has also been good.

David's Ship's Tiller Apparatus.—This ingeniously contrived arrangement, which forms one of the minor novelties of the Paris Exhibition, is represented in plan in our figure. The rudder-head, A, has two horizontal arms, B, fixed to it at an angle apart of about 150°. Chains, D, are connected to the ends of the arms, B, and pass to the barrel, E, the spindle, F, of which is carried in bearings, L, upon an open frame, K. This frame is supported by the bar, G, jointed to the centre of the rudder cap, A, and by the single standard, I, in front, the usual rudder wheel, J, being fixed on the front overhanging end of the spindle, F. Each arm, B, has a separate chain connected to it, one end of which chain is fixed to the arm at H, passes thence round a pulley carried by the frame, K, at N, returns to a pulley, C, carried by the arm, B, and then passes again to a second pulley at C, which guides it upon the barrel, F, to one end of which it is fixed. The chain from the other arm, after passing through a similar course, is fixed to the other end of the barrel, E, which is grooved helically to receive the chains. The barrel, E, is capable of sliding longitudinally upon a feather on the spindle, F, and shifts so as to constantly pay off the chain on one side and receive it on the other at the same point, being accurately guided by a bar, M, fixed across the frame, K, and projecting down into the helical groove in the barrel. The chains are thus kept at a uniform tension, the difference in the distances, as taken at different positions of the rudder, being quite inappreciable. The arrangement of the chains and pulleys can be varied according to the power required to act upon the rudder, that of the example trebling the power, as three times the length of chain requires to be wound on the barrel, to make the arms, B, travel through a given arc.

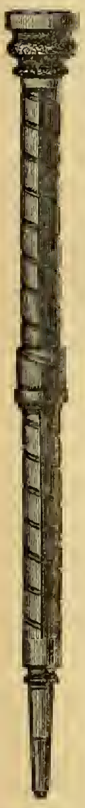


Railway Working Expenses in Canada.—The following statement of the locomotive costs on the Great Western Railway of Canada, prepared by Mr. Henry Yates, the locomotive superintendent at the Hamilton station, is interesting, as letting us see what colonial lines are doing:—

Total cost of locomotive power for running passenger and freight trains, including all repairs, for six months ending 31st July, 1855,	£25,046. 2s. 0½d. stg. 11d.·933 per mile run.
Number of engines for working passenger and freight trains,	40
Average number of engines in working order,	34 daily.
Do. do. under repair,	5
Do. do. renewing,	1
Total number of miles run by passenger and freight trains,	503,781
Average number of miles run per day, (no trains on Sunday),	3,250
Average number of miles run by each engine,	15,266
Passenger trains averaged	5,500 carriages.
Do. weight with contents,	80 tons.
Freight trains averaged	16,247 carriages.
Do. weight with contents,	250 tons.
Quantity of wood consumed for the six months,	13,373 cords.
Average number of miles run with one cord of wood,	37½
Cost of fuel per mile run,	4d. ·080 stg.
Each passenger carriage is capable of holding,	65 passengs.

Association for the Prevention of Boiler Explosions.—Since our October report of the progress of this association, no fewer than 135 establishments of the members have been visited by Mr. Longridge the inspector. At these works, 376 boilers have been examined. The report of the inspecting engineer says:—With few exceptions these boilers are in a good condition, and the mountings in good working order; but in four instances the safety-valves were found in such a state as to render the safety of the boilers very uncertain. There have been no cases of explosion during this period. Of the engines, 80 have been indicated, in some of which the diagrams show considerable waste of power, partly from errors in setting the valves, and the ordinary defects arising from wear and tear, but frequently also from the misapplication of high-pressure steam. It is not unusual to find the steam in the boiler twice or three times the pressure at which it enters the cylinder, whereby the chief advantage of high-pressure steam is lost, and the boiler exposed to an unnecessary strain. Of the good that must spring from this system of surveillance, there cannot be the slightest doubt.

SWISS DRAWING INSTRUMENTS.—Some of these instruments have been lately submitted to us by Mr. Barlow. They are very neat in appearance, and the workmanship is good and well-finished. The prices are stated to be less than those of instruments commonly found on the draughtsman's table; and they are made in different styles, to suit the different classes of purchasers.



TAYLOR'S EVER-POINTED PENCIL.—The simple ever-pointed pencil, with a spiral groove round the external surface of its wooden barrel, has deservedly enjoyed a long success at the hands of the public. It is now improved upon by Mr. J. G. Taylor, who makes the barrel of metal, and adds an ingenious contrivance for getting rid of the objectionable points of the traversing piece standing up, one on each side of the nut. Our figure represents the new pencil in full size, external elevation. The barrel is made of sheet gold, with the spiral groove or screw rolled upon it, under severe pressure. The propeller or traverser for adjusting the pencil lead has only one prominence upon it, projecting through the longitudinal slot, and this prominence, which forms the connection between the pencil lead and the external screw traverser or nut piece, is quite covered up by the latter. The screw traverser has an internal annular groove in it, and it is this groove which receives the prominence. Hence the screw traverser is perfectly plain, except that it has an annular bead or ridge upon it, being quite pleasant to the touch in handling for adjustment and use, whilst the general appearance of the pencil is greatly improved.

MORTISING AND TENONING MACHINE WITH ROTATORY CUTTERS.—A clever system of rotatory cutters, adapted for producing mortises and tenons in wood, has been put in practice by Messrs. Bunten and Lamb of Port-Glasgow, with satisfactory results. In this machinery the cutting tool is held in a small frame formed with slides, and working between a pair of vertical guides, a reciprocating motion being given to the frame by a crank or eccentric movement overhead. The crank or eccentric shaft, and pulley for driving it by, are carried by a frame which is capable of traversing vertically, so as to bring the tool more deeply into the wood beneath as the formation of the mortise progresses. This depressing action is effected by means of a foot lever, connected by a rod to the sliding frame above. The cutting tool is attached to a spindle, which is capable of turning in bearings in the lower reciprocating frame. This spindle has fast upon it a small pinion in gear with a short rack working in a slot across the frame, and a pin upon the rack projects behind, through the slot, and carries a friction pulley, upon which a transverse sliding piece is made to act when the tool is required to turn. This sliding piece works transversely in slots in the stationary framing, and has two double inclined pieces upon it for effecting the reversing action, which can be done without stopping the machine. When the tool is to be turned, the sliding piece in the frame is thrust to one side; and if the friction roller carried by the rack happens at the moment to be directly opposite to the inclined piece, the rack is at once forced across, and turns the tool. If the rack is above or below the sliding piece, its next descent or ascent brings the friction roller upon the incline, and the rack is similarly forced across by the incline, and turns the tool. When the tool is to be turned again, the sliding piece is shifted across, back again, and the friction roller carried by the rack is acted upon by the inclined piece on the other side. The tool is held accurately square in each position when turned, by a spring fixed to the frame, the blade of which spring presses upon a flat or planed portion of the tool-holder spindle, this spindle pressing back the blade in turning. In cutting tenons, it has been an object with the inventors to save the wood cut from the sides of the tenon as much as possible; whilst, at the same time, the pieces cut away are made of uniform thickness, to render them more suitable for any purpose to which they may be applied. The board or piece of wood to be cut is secured upon a holding frame, similar to a lathe slide-rest, and capable of traversing upon V slides. The end of the wood upon which the tenon is to be formed, is presented laterally to the cutting action, and traversed past four horizontal revolving circular saws fixed upon a vertical spindle, and driven at a rapid rate. The two inner saws cut into the wood, and separate the side pieces from the central portion, which will constitute the actual tenon. The two outer saws are merely for thicknessing the side pieces to be cut away, and may be dispensed with if these side pieces are not to be used for any purpose requiring such thicknessing. Various numbers of horizontal saws may be used, according to the particular manner in which it is wished to shape the tenon or the pieces cut from it. Cutters of various descriptions may likewise be substituted for the saws, or be used in combination with them, as for producing mouldings, for example. As the wood is traversed past the horizontal saws, it enters between two rapidly revolving spindles, carrying cutters, which act vertically, and cut off the upper and under side pieces, previously separated by the horizontal saws from the central tenon piece which remains—and this completes the operation of the machine. Saws revolving vertically, that is to say, upon horizontal spindles, may be substituted for the revolving cutters described as for giving the final separating cut to the pieces taken from the sides of the tenon; or the vertically revolving cutters may be shaped so as to produce mouldings upon the wood acted upon by them. The spindles of these cutters or saws are carried in bearings, in the ends of arms or cranks, fast on spindles held in fixed bearings. These spindles are capable of adjustment, so as to set the arms at any angle, and thereby vary the distance between the cutters or saws as may be required. It will be obvious that the positions of the cutting apparatus of the tenoning machine may be modified as may be convenient, provided their relative positions are maintained as described; that is to say, provided the two sets of cutters or saws are made to act in directions at right angles to each other.

HANSON'S POTATO-DIGGING MACHINE.—A most useful and ingenious machine, invented by Mr. Hanson of Ballycalket, Doagh, Belfast, for the purpose of superseding hand labour in raising potatoes, and lately used, with great success, in Ireland, was tried, the other day, on the farm of Mr. Renwick, Garbraid, near Glasgow, in the presence of a large gathering of agriculturalists. The implement, which is simple enough to recommend itself at once to the potato grower, consists of an open timber frame, bearing some resemblance to a hand-cart. The back part of the frame is supported upon a pair of large running wheels, set upon a transverse rotating axle, on the central portion of which is a bevil wheel driving a bevil pinion, fast on the forward end of a longitudinal shaft, carried in bearings in the centre of the frame. The rear end of this shaft projects beyond the frame, and carries a wheel or ring of radial digging forks, disposed like the paddle arms of a steamer, and revolving at a right angle to the line of the implement's path. Immediately beneath the digging wheel, there is a broad horizontal ploughing-share, carried by the frame, the share surface being just clear of the tips of the digging forks as they revolve in working. This plough piece, which is adjustable vertically to suit the depth of action required, passes along beneath the drill of potatoes, deep enough to lift up both the manure and the potatoes. In this way, as the manure and the potatoes are elevated upon the share, the rotatory action of the forks scatters out the potatoes, which can then be easily removed. The front portion of the digger is supported upon a pair of small adjustable running wheels, so contrived that the attendant can set the front end of the frame up or down by merely shifting a vertical lever. The machine is drawn by a pair of horses attached to this end of the frame, and, as the share passes along and brings up the earth, manure, and potatoes, it lifts the entire mass within range of the revolving forks, and every potato is thus thrown out of the drill ready for hand gathering. The trial which we witnessed on the Gairbraid farm was completely successful. Each drill was disembowelled with surprising rapidity, and we remarked that not one of the potatoes seemed to be marked by the forks. Amongst the gentlemen present at the trial, all apparently delighted with the machine's work, were James Douglas, Esq., of Athelstaneford; A. Buist, Esq., factor for Sir A. J. Campbell; Hugh Kirkwood, Esq., of Killermont; Andrew Renwick, Esq., of Gairbraid; W. Graham, Esq., of Lambhill; Matthew Wilson, Esq., overseer for Lord Blantyre; R. Brown, Esq., Sandyflat; Messrs. Craig, of Buckley; Imrie, Blackhill; Rennie, Kessington; Buchanan, Garscadden, Mains; Paterson, Drumry; Campbell, Possill; Graham, Garthamlock; Murray, overseer of the Blythswood Estates; Riddell, Kirby, Yoker. The machines, which can be produced at a price low enough for all extensive growers, are being made by Messrs. Alexander Chaplin & Co., Cranstonhill.

MARINE MEMORANDA.—The quondam "hot air" *Ericsson* has got to work as an ordinary steamer on the New York, Southampton, and Bremen line. After some fair voyages between New York and Havre, she made the run to Cowes in a little over 13 days. Her hull, of 2,200 tons, turns out to be a most beautiful model.

ALUMINIUM.—This metal continues to occupy the attention of the scientific world. M. Deville's process for obtaining it, is to precipitate it by a galvanic battery from the chloride; and his method of preparing the chloride, is to mix calcined alumina with charcoal, and then by means of oil to form a paste of the mixture, which is baked in an earthen crucible. Pieces of a convenient size are placed in a tubular stone retort, similar to that employed by Ebelmen in obtaining chloride of silicium. The inside of such a retort must not, however, be glazed with oxide of lead. Heat is applied to the retort until the whole attains a dull red, and a current of chlorine is then passed rapidly through it. The action of the gas is first to drive off the water, and this being done, chloride of aluminium is produced. Hydrochloric acid would produce a similar result with a greater degree of heat. To collect the product, a bell-glass receiver may be employed with a socket fitting into the neck of the retort; a funnel closes the open end of the receiver to which it is luted. The socket of the receiver ought to be highly heated during the process in order to prevent its choking, and for this purpose it will be well not to let it project more than two inches out of the furnace. The carbonic oxide, a very deleterious gas produced during the process, ought to be consumed to prevent injury to the operator. M. Deville has obtained 10 lb. of chloride of aluminium in this way in one day. Aluminium is a very good conductor of electricity, its conducting power, compared with that of iron, being 8 to 1. It has also a slight magnetic power. Its ductility and malleability are such, that thin sheets and fine wire may be made of it without annealing. It does not clog the file like malleable iron, and works easily under the tool.

ALGERIA.—We wish that our own colonies advanced as rapidly, and with such signs of substantial prosperity, as the French colony of Algeria. Its climate admits of a vast range of vegetable productions. The plants of the tropics, and those of temperate zones, are found flourishing alike. In 1844 the European cultivators of tobacco were only 3; in 1854 they numbered 2,323. In the former year the ground covered with tobacco was about 3½ acres, in the latter year it was 7,047 acres. The weight of dried leaves produced by the colonists in 1844 was 2,416 lbs.; in 1854 it was more than six millions of lbs. The manufacture of cigars is a considerable branch of industry, employing large numbers of women and children. Cotton of excellent quality is produced in Algeria; and in 1854, about 4,200 acres were devoted to its cultivation. In time, France hopes not only to derive all the cotton she requires from her own territory, but to be able to supply much of the demand throughout Europe. As to silk, in 1853 Algeria produced nearly 32,000 lbs. of raw silk, or cocoons, and her production is rapidly on the increase. The mother country is ready to absorb all that Algeria can supply her with for some years to come, for in 1853 she imported from all parts of the world cocoons, raw silk, &c., to the amount of 53½ millions of lbs., and to the value of 160 millions of francs. Algeria exports, besides cotton, tobacco, and silk, cochineal, oil, flax, hemp, madder, and perfumes. The sugar-cane, vanilla, the opium-yielding poppy, and the New Zealand flax plant, have been tried and found to answer. Honey, dyeing lichens, and indigo, are produced to some extent, as well as pimento and henna. A good collection of the products of Algeria may be seen in the Exposition Universelle, and the French are properly proud of their number and variety. Here are exhibited ores, ornamental stones, and woods. The forests of Algeria are very extensive, the three provinces containing, it is calculated, nearly three millions of acres covered with wood. Collections of fruits, seeds, oils, and resins are also shown.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded May 28.

1218. Joseph Leese, jun., Manchester—An improvement or improvements for obtaining colouring matter.

Recorded June 20.

1411. Giovanni M. de Martinoi, Valesolis, Tuscany, and Juan F. O. de Lara, Spain—Invention for the employment of a new material in the manufacture of paper.

Recorded June 21.

1648. William Striby, Weinheim, Baden—A new and improved system of musical notation.

Recorded August 18.

1876. Omer J. Henry, Paris, and 4 South-street, Finsbury—Improvements in bookbinding.

Recorded August 25.

1928. Charles F. Stansbury, 67 Gracechurch-street—An improved shirt wristband.—(Communication.)

Recorded August 30.

1963. William Gossage, Widnes, Lancashire—Improvements in the manufacture of carbonates of ammonia, and in the useful application of such carbonates.

Recorded September 1.

1971. Matthew Butcher and Thomas H. Newey, Birmingham—An improvement or improvements in the manufacture of bobbins used in winding, twisting, and weaving fibrous substances.
1973. Thomas Dodds, 53 Wigmore-street, Cavendish-square—Improvements in the construction of an apparatus for beating all kinds of furnaces with coal or other gases.
1975. Frederick C. Calvert, Manchester—Improvements in the treatment of heating, puddling, and refining iron slags or cinders.
1977. Thomas S. Prideaux, Willow-house, Hampstead—Improvements in marine steam boiler furnaces and flues.
1979. Alfred V. Newton, 66 Chancery-lane—Improvements in the manufacture of gas for illumination.—(Communication.)
1980. William Smith, 10 Salisbury-street, Adelphi—An improved smoke-consuming furnace.—(Communication.)

Recorded September 3.

1981. William M'Liesh, Belfast—Improvements in steam boiler and other furnaces, and in the prevention of smoke.
1982. Alfred Heaven, Manchester—Improvements in embroidering fabrics.
1983. George T. Holden and Richard Nicholas, Birmingham—An improved roasting-jack.
1985. James T. Chance and Henry Adcock, Birmingham—Improvements in casting articles of the slags produced by the smelting of iron and other ores.
1987. Edouard Sy, Paris, and 32 Essex-street, Strand—New method of obtaining motive power.
1989. Henry E. Flynn, Ranelagh, Dublin—Making connections between and adapting appliances to locomotives and all descriptions of railway carriages, whereby the possibility of accidents resulting from the breakage or dislocation of their wheels or axles is prevented, or the chances thereof greatly diminished.
1991. John Humby, 47 Little Britain—An improved machine for cutting vegetables.
1993. George H. Golding, Maidstone—A tool or apparatus to be used in the blocking and lasting of leather, and in other cases where a covering is required to be drawn over a solid substance.

Recorded September 4.

1995. Cyrus Clark and James Clark, Street, near Glastonbury—An improvement in the manufacture of boots and shoes.
1997. John G. Taylor, Glasgow—Improvements in coating, covering, or plating metallic surfaces.
1999. Thomas T. Coniam, Chagford, Devonshire—Improvements in tiles for roofing.
2001. Charles G. Mueller, South Carolina, U.S.—Certain new and useful improvements in locks for doors.
2003. William A. Gilbee, 4 South-street, Finsbury—Improvements in the manufacture of glass.—(Communication.)
2005. William Southwell, Philadelphia, U.S.—Certain improvements in machinery for grinding or polishing saws and other articles.

Recorded September 5.

2007. George H. Ingall, Bartholomew-lane—Certain improvements in railway self-acting signal-posts and apparatus connected therewith.
2009. George Collier, Halifax—Improvements in the manufacture of carpets and other pile fabrics.
2011. John H. Glassford, Glasgow—Improvements in printing textile fabrics and other surfaces.
2013. Joseph G. Martien, Newark, U.S., but now resident in London—Improvements in roasting, calcining, oxydizing, and subliming metallic and mineral substances, and in the apparatus and means to effect the same.

Recorded September 6.

2015. Samuel A. Goddard, Birmingham—A new or improved method of preventing the injurious fouling of the barrels of firearms, and of cleaning the same when fouled.
2017. Christopher P. Aston, Cross-street—Improvements in breech-loading arms.

Recorded September 7.

2021. George Lowry, Manchester—Improvements in machinery for heckling flax and other fibrous materials.
2023. Florentine Garand, Paris, and 46 Regent-street—Improvements in machinery for cutting veneers.
2025. Nathaniel Templeton and David Miller, Glasgow—Improvements in the manufacture of figured fabrics.
2027. John M'Intyre, Jarrow-upon-Tyne—Improvements in apparatus for caulking decks, ceilings, and floors.
2029. Louis P. Reynaud, Paris, and 4 South-street, Finsbury—A new system of endless stair crane.

Recorded September 8.

2031. Eugene H. Rascol, Catherine-street, Strand—An improved fastening for articles of wearing apparel, and for other purposes, as a substitute for buttons.—(Communication.)
2033. Joseph H. Tuck, Pall-mall—Improvements in dredging and excavating machinery.—(Communication.)
2035. Thomas Hemsley and William Hemsley, Melbourne, Derby—Improvements in the manufacture of fabrics in warp and twist lace machines.
2037. James Bird, Seymour-street West—An improvement in the manufacture of biscuits.
2039. Pier A. Balestrini, Brescia, Lombardy—Improvements in insulating wires for electric telegraphs.
2041. Andrew Robertson, Nether Holehouse, Neilston, Renfrewshire—Improvements in the treatment, cleansing, and finishing of textile fabrics.
2043. Eugéne Grenet, junior, Paris—An improved electro-magnetic apparatus for motive power, part of which may be employed separately for the generation of electric currents.
2045. Thomas Allan, Adelphi-terrace, Westminster—Invention of certain means of correcting or preventing the deviation of the compass needle from local attraction.

Recorded September 10.

2047. Edmund Sharpe, Swadlincote, Derbyshire—Improvements in pans for water-closets.
2049. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in paddle-wheels.—(Communication.)
2050. Auguste E. L. Bellford, 32 Essex-street—An improved governor for steam engines. (Communication.)
2051. Thomas Craven, Nelson-street—Improvements in furnace bars.

Recorded September 11.

2053. Henry Bull, Knowle-green-house, Staines—Railway permanent way materials.
2055. Thomas Heaton, Blackburn—Improvements in pumps.
2057. Matthew Curtis and John Wain, Manchester—Improvements in machinery for preparing and spinning cotton and other fibrous substances.
2058. Joseph C. G. Kennedy, St. James'-street, Piccadilly—Improvements in the mode of and apparatus for transmitting signals by the use of the electric current, part of which improvements is applicable to the regulating of machinery generally.—(Communication.)
2059. Etienne C. Z. Bouchard, Paris—Certain improvements in producing gas for lighting and heating.

Recorded September 12.

2061. John Macintosh, Great Ormond-street—Improvements in springs.
2063. Francis G. Spilsbury, Chaud-fontaine, Belgium, and Frederick W. Emerson, Stable Hobba, near Penzance—Improvements in the manufacture of paints and pigments.

Recorded September 13.

2065. Benjamin Barber, Tring, and John Butterfield and Thomas Austin, Great Berkhampstead—Improvements in mangles.
2066. John Macintosh, Great Ormond-street—Improvements in metallic and other pens.
2067. Pierre B. de Lucenay, Paris—Certain improvements in the batteries of guns and pistols.
2069. John Blissett, 322 High Holborn—Improvements in the construction of revolving chamber fire-arms.
2070. Joseph H. Tuck, Pall-mall—Improvements in apparatus for carrying on submarine operations.—(Communication.)
2071. Abram Longbottom, 41 Moorgate-street—Improvements in the manufacture of gas when oils or fatty matters are used.

Recorded September 14

2072. Jules A. Hartmann, Mulhouse, France—Certain improvements in the preparation and combination of colours for printing stuffs and textile fabrics.
2073. Jean P. Garbai, Paris—An improved powder or composition for cleaning and serving the teeth.
2074. William Church, Birmingham—Improvements in mounting and adjusting ordnance and other fire-arms.
2075. Théodore Gomme, jun., and Charles E. A. Beaugrand, Paris, and 32 Essex-street, Strand—Certain improvements in machinery for manufacturing copper and other metal wares.
2076. Vincent Scully and Bennett J. Heywood, Dublin—Improvements in bottles, inkstands, and other vessels, and in caps or stoppers for closing the same.
2077. George Dewdney, Fenchurch-street—An improved manufacture of protector applicable to the chest, throat, and other parts of the body requiring protection from the cold.
2078. Frederick Stocken, 5 Halkin-street, Belgrave-square—Improvements in carriage springs.
2079. William F. Thomas, St. Martin's-le-Grand—Improvements in sewing machines.

Recorded September 15.

2080. William Oxley, Manchester—Improvements in machinery or apparatus for washing fabrics and other substances.
2082. Joseph G. Martien, Newark, New Jersey, U.S.—Improvements in the manufacture of iron and steel.
2084. Vincent Scully and Bennett J. Heywood—An improvement in the manufacture of certain articles which are subject to the corroding action of the air and moisture.
2086. William Sangster, Cheapside—An improvement in the manufacture of stays and corsets.
2088. David Zenner, Newcastle-upon-Tyne—Improvements in washing and separating pulverized ores and matters—(Communication.)
2090. Alfred Ford, St. James's, Middlesex—Improvements in preparing solutions of caoutchouc, gutta percha, and like gums for waterproofing and other useful purposes.

Recorded September 17.

2092. Joseph Lewtas, Manchester—Improvements in apparatus for holding and letting go cords, chains, or bands.
2094. Thomas Forsyth, Manchester—Improvements in the treatment of scrap-iron in the process of manufacture.
2096. William H. Smith, Birmingham—An improvement or improvements in bolts, latches, and locks.
2098. James T. Caird, Greenock—Improvements in steam engines.
2102. Richard A. Brooman, 166 Fleet-street—Improvements in obtaining raw silk, which are also applicable to fibres worked in a wet state.—(Communication.)

Recorded September 18.

2106. Richard A. Brooman, 166 Fleet-street—Improvements in knitting machinery.—(Communication.)
2108. Feridoon H. Smith, Ludgate-hill—An improved break for carriages with poles.
2110. William Warren, Regent-place, Birmingham—Improvements in the construction of vices.

Recorded September 19.

2112. Louis Cornides, 4 Trafalgar-square—Certain improvements in obtaining impressions of prints or drawings, and in transferring, printing, and colouring, or ornamenting the same on glass or other surfaces.
2114. Samuel Coulson, Sheffield—An improvement in the manufacture of ornamented metal tea-pots, coffee-pots, milk-jugs, and sugar-basins.
2116. Richard A. Brooman, 166 Fleet-street—Improvements in preserving animal and vegetable substances.—(Communication.)

Recorded September 20.

2118. Henry Deacon, Widnes-dock, near Warrington—Improvements in the manufacture of solutions of carbonate of ammonia, and in the manufacture of caustic ammonia.
2120. John Palmer, Stockton-on-Tees—Improvements in the construction of reaping machines.

Recorded September 21.

2122. John Dale, Manchester—Certain improvements in appropriating waste products arising in the manufacture of certain chemical compounds.
2124. Ursurer J. Brasseur, 40 Rue de Hambourg, Paris—Improvements in machinery for winding weft.—(Communication.)

Recorded September 22.

2126. James Eaton, Charing-cross, Strand—Improvements in shuttles, and in making cop-tubes used in shuttles.

Recorded September 24.

2128. Hector Mottet, jun., Verviers, Belgium—Invention for scouring woollen goods during the action of fulling or otherwise.
2130. John M. Marchinton, Sheffield—Improvements in the construction of vices.
2132. Charles Manby, 25 Great George-street, Westminster, and William Piper, Palace-road, Stangate—Improvements in machinery for cutting stone.—(Communication.)
2136. George Simmonds, Bennett-street, Stamford-street, Blackfriars-road—Improvements in the construction of bedsteads.

Recorded September 25.

2138. William Wright and John Wright, Stamford—Improvements in machinery for crushing grain.
2140. Charles F. Whitworth, Halifax—Improvements in signals used on railways, and in parts of apparatus in connection therewith.
2142. Frederick R. Ensor, Nottingham—Improvements in bobbin-net or twist lace machines.

Recorded September 26.

2144. Gustavus Huguenin, Greek-street, Middlesex—Certain improvements in watches and other timekeepers.
2146. John Norbury, Salford—Certain improvements in machinery or apparatus applicable to hydraulic presses.
2148. James Nasmyth, St. Germain-en-Laye, France—Improvements in the modes of obtaining motive power by a rotary or circular movement, and of applying it.

Recorded September 27.

2152. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and Paris—Improvements in forging iron.—(Communication.)
2154. Matthew Atkinson, Wandsworth, and Benjamin Ridge, Putney—Improvements in the construction and setting of steam boilers for economizing fuel, and for rendering the same applicable, not only to the generation of steam, but also to ventilation, the distillation of water for ships' use, and the distribution of heat for general purposes.
2156. James Newman, Birmingham—Improvements in the manufacture of railway wheels.
2158. Josias Nottidge, Atlas Chemical Works, Locksfields, Walworth—Improvements in the manufacture of manure.

Recorded September 28.

2160. John H. B. Thwaites, Bristol—Improvements in the preservation of teeth, and in the manufacture and application of artificial teeth.
2162. John T. Pitman, 67 Gracechurch-street—An improved screw wrench.—(Communication.)
2166. Robert Rohey and George L. Scott, Lincoln—Improvements in locomotive and other boilers.
2168. James Good, Lincoln—Improvements in straw-shakers of thrashing machines.

Recorded September 29.

2172. William B. Herapath, Bristol—Improvements in the manufacture of surgical instruments.

Recorded October 1.

2176. John Gedge, 4 Wellington-street South, Strand—Improvements in the manufacture of braid.—(Communication.)
2178. John Gedge, 4 Wellington-street South, Strand—Improvements in the preservation of grain.—(Communication.)
2182. George Wilkinson, 17 Evan-street, Poplar—Improvements in steering apparatus.
2186. Joseph F. V. Augier, Paris, and 4 South-street, Finsbury—An improved apparatus for extracting the aroma from plants and flowers.
2188. Thomas Dickins, Middleton, Lancashire—Improvements applicable to machinery for doubling and throwing silk, and for doubling other fibrous materials.
2190. George C. Hope, Hastings, Sussex—An improved method of producing figures, patterns, or designs upon textile fabrics for the purposes of needlework.

Recorded October 2.

2192. Alexander Sands, Manchester—Improvements in securing rails in railway chairs.
2194. Laurent-Marie-René Péan, Paris—An improved inkstand.
2196. Richard Threlfall and William Knowles, Preston—A certain improvement in looms for weaving.
2198. Julian Bernard, Club-chambers, Regent-street—Improvements in the manufacture or production of boots and shoes or coverings for the feet, and in the machinery or apparatus, and in the materials employed in such manufacture.
2200. François F. Benvenuti, Paris, and 4 South-street, Finsbury—Certain improvements in typography.
2202. George L. Stott, St. George's, Gloucestershire—Improvements in the manufacture of carbonate of soda.

Recorded October 3.

2204. William Ramscar, Manchester—Improvements in fire-arms, which improvements are also applicable to cannons and all kinds of field-pieces.
2206. William Patterson, Batley, and George Patterson, Sowerby-bridge, Yorkshire—Improvements in machinery or apparatus for moistening or damping woollen or other textile fabrics for finishing.
2208. John Dickinson, Old Bailey—An improvement in the manufacture of paper.
2210. William E. Newton, 66 Chancery-lane—Improved machinery for separating gold and other metals from their ores.—(Communication.)

Recorded October 4.

2212. Henry Oldham, Leeds—An improvement in weaving textile fabrics.
2214. John Lancaster, Deptford—An improved water-proof material.
2216. Thomas H. Ryland, Birmingham—A new or improved manufacture of bracelets, and other dress ornaments, and ornamental dress fastenings.
2218. Caleb Hardy, Carstairs, Lanarkshire—Improvements in effecting communications between the guard and engine-driver, or between the various parts of a railway train.
2220. Edward Meldrum and James Young, Glasgow—Improvements in the manufacture of certain salts of sodium and potassium.
2222. Henry Over, Cambridge—Invention of a novel construction of gauge knife.

Recorded October 5.

2224. Peter A. Halkett, Windham Club, St. James'—Improvements in the application of motive power to, and in obtaining locomotion for, the cultivation of land.
2226. Jean D. Pfeiffer, Paris—Improvements in the construction of knives or cutters.
2228. Richard H. Hills, Castle-banks, Lewes, Sussex—Invention of a jointed backband for gig or brougham harness, affording instant relief to fallen horses, and always inclining to the draught of the traces.
2230. Thomas Dickens, Middleton, Lancashire—Improvements in machinery or apparatus for spinning, doubling, and throwing silk, and doubling other fibrous materials.
2232. François C. Lepage, Paris—Invention of a new composition or new compositions of materials, which may be employed as a substitute for wood, leather, bone, metal, and other hard or plastic substances, and the method of manufacturing the same.

Recorded October 6.

2234. Adolph Coutinho, Oldham—Improvements in the means of obtaining motive power or continuous motion.
2236. James Washington, Batley, near Dewsbury, Yorkshire—Improvements in apparatus for sweeping chimneys or flues.
2238. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in apparatus for consuming smoke, to be applied to lamps and gas-burners—(Communication from Jean B. T. Andry, Paris.)
2240. Herbert W. Hart, Birmingham—An improved cannon for gun-boats.

Recorded October 8.

2242. John Huhbard, Alhion-road—An improved sole for boots and shoes.
2244. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in machinery or apparatus for the transmission and conversion of motive power.—(Communication from Jules F. L. E. Lesénéschal, Paris.)
2446. James H. Henry, Glasgow—Improvements in floating vessels for carrying goods and passengers on the water.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

DESIGNS FOR ARTICLES OF UTILITY.

Registered from August 31 to Sept. 25.

Aug. 31st,	3748	J. Eddy, Exeter,—" Plough."
Sept. 3d,	3749	Goodall & Son, and Mould & Tod, Camden-town,—" Powder envelope."
—	3750	Dent, Allcroft, & Co., Wood-street,—" Tilbury glove."
—	3751	T. Binns & G. Binns, Huddersfield,—" Expanding envelope."
6th,	3752	J. Parkes, Birmingham,—" Dress fastener."
—	3753	Hume and Melville, Edinburgh,—" Embossing stamp."
10th,	3754	J. Eagles & Son, Walsall,—" Brush."
11th,	3755	S. Hemming, Bow,—" Fireproof building."
14th,	3756	Tucker & Son, Strand,—" Cooking lamp."
18th,	3757	H. Bird, Stourbridge,—" Mouthpiece for cornopeans."
—	3758	Donaldson, Hirsch, & Spark, Goswell-road,—" Shirt."
19th,	3759	H. B. Peacock & Son, Manchester,—" Carriage mantle."
20th,	3760	E. R. & T. Turner, Ipswich,—" Mill-frame."
25th,	3761	R. Linneker, Derby,—" Smoke-consuming furnace."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered

Aug. 29th,	688	J. H. G. Wells, Tottenham-court-road,—" Lamp-oil indicator."
Sept 5th,	689	T. Pope, City-road,—" Flower-pot."
10th,	690	G. Kane, Dublin,—" Hinge joint."
12th,	691	W. H. Bentley, Bedford,—" Liquid heating apparatus."
—	692	W. B. Edridge, Fulham-road,—" Office paper binder."
—	693	H. L. Burton, New-road,—" Carriage-break."
17th,	694	R. J. Lawrence & J. Allday, Birmingham,—" Locket stereoscope."
20th,	695	J. Boucher, Chancery-lane,—" Bullet."
—	696	J. Callingham & B. Fillmer, Preston Kent,—" Water-wheel."
24th,	697	W. D. Gray, Old Kent-road,—" Indicator."
25th,	698	M. Smith, Poland-street,—" Paletot mantle."
—	699	E. Edwards, Birmingham, " Insect trap."

TO READERS AND CORRESPONDENTS.

A SUBSCRIBER, WESTMINSTER.—We hope to be able to gratify him next month.

A SUBSCRIBER.—The entire technical literature of this country does not embrace the work he wants. Something is at present in preparation. We will let him know when it will be available.

WATER METER,

KENNEDY'S PATENT WATER METER COMPANY,

KILMARNOCK.

Fig. 1.

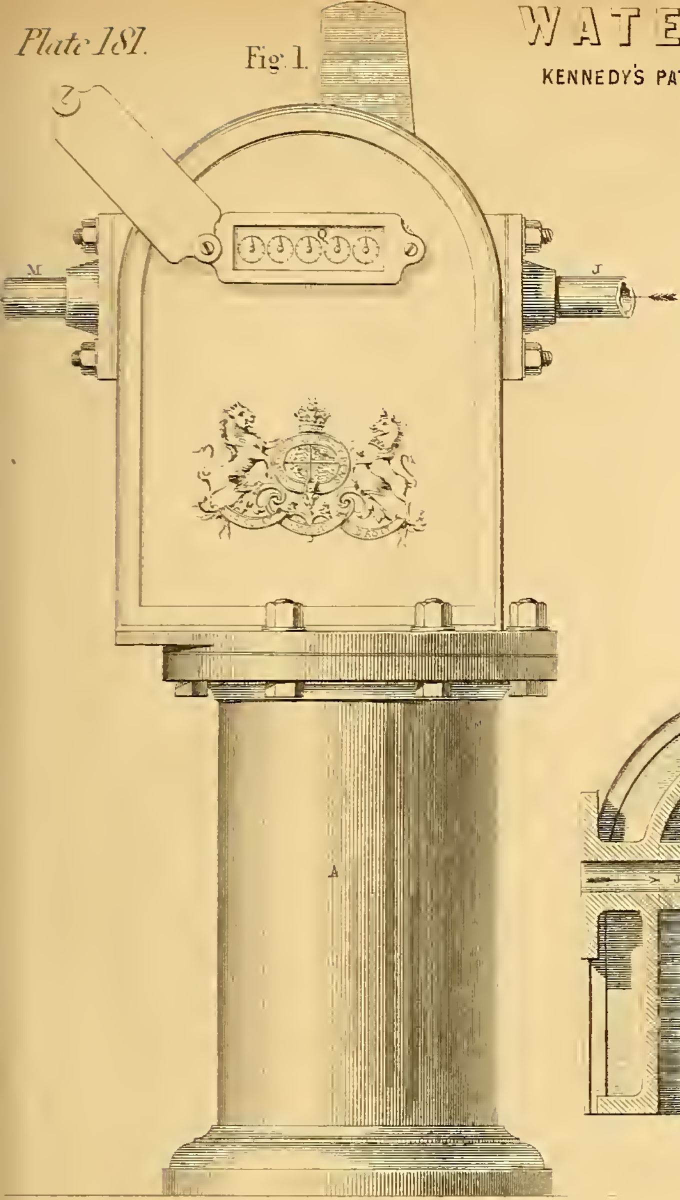


Fig. 2.

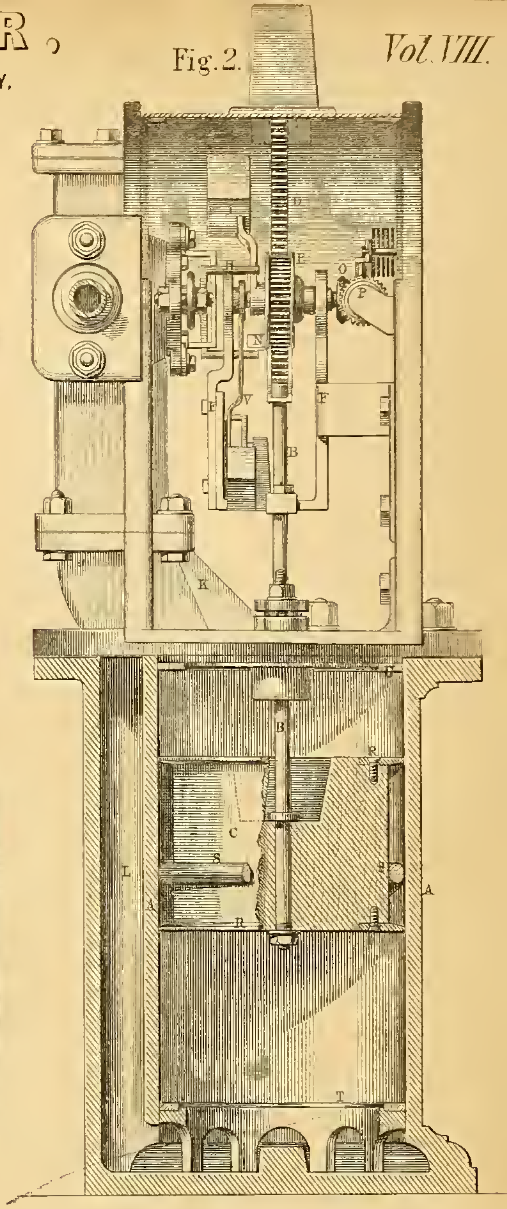


Fig. 5.

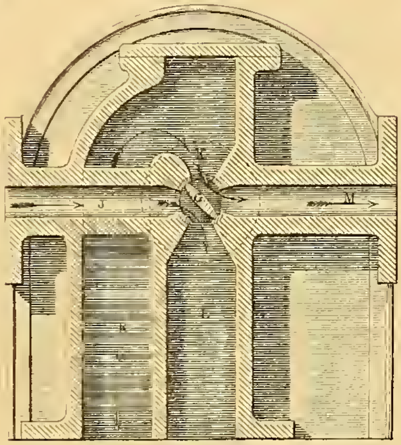


Fig. 3.

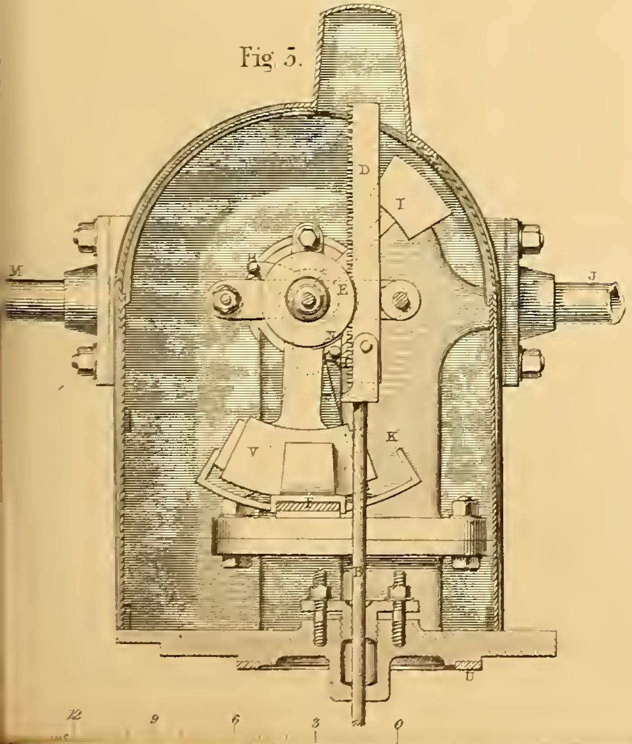


Fig. 6.

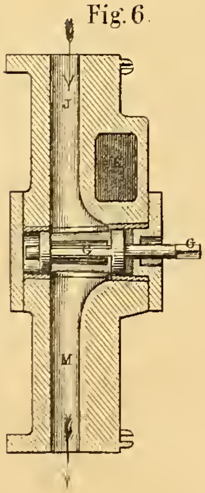
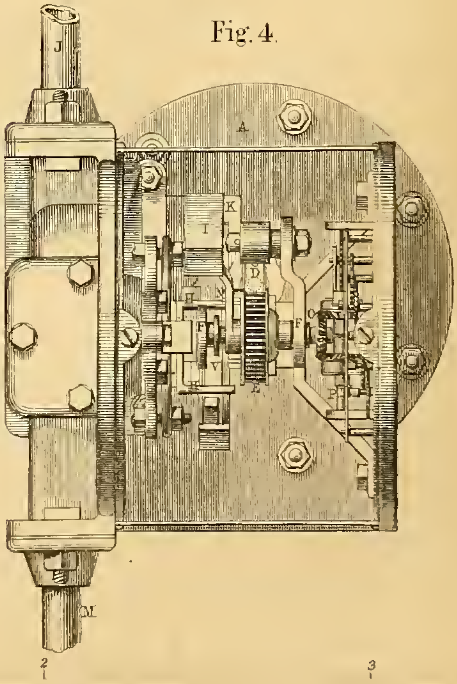


Fig. 4.



SCALE

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Plate 182.

ADVANCE-BLADED CONO

EDMUND HUNT

GLAS

Fig. 1.

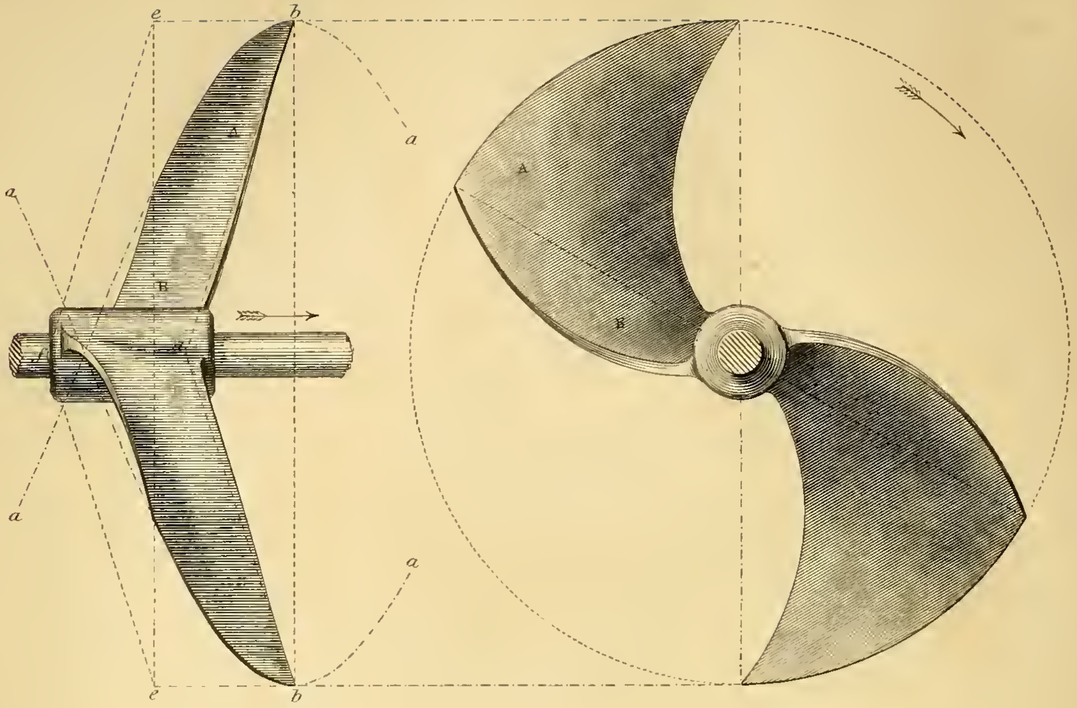
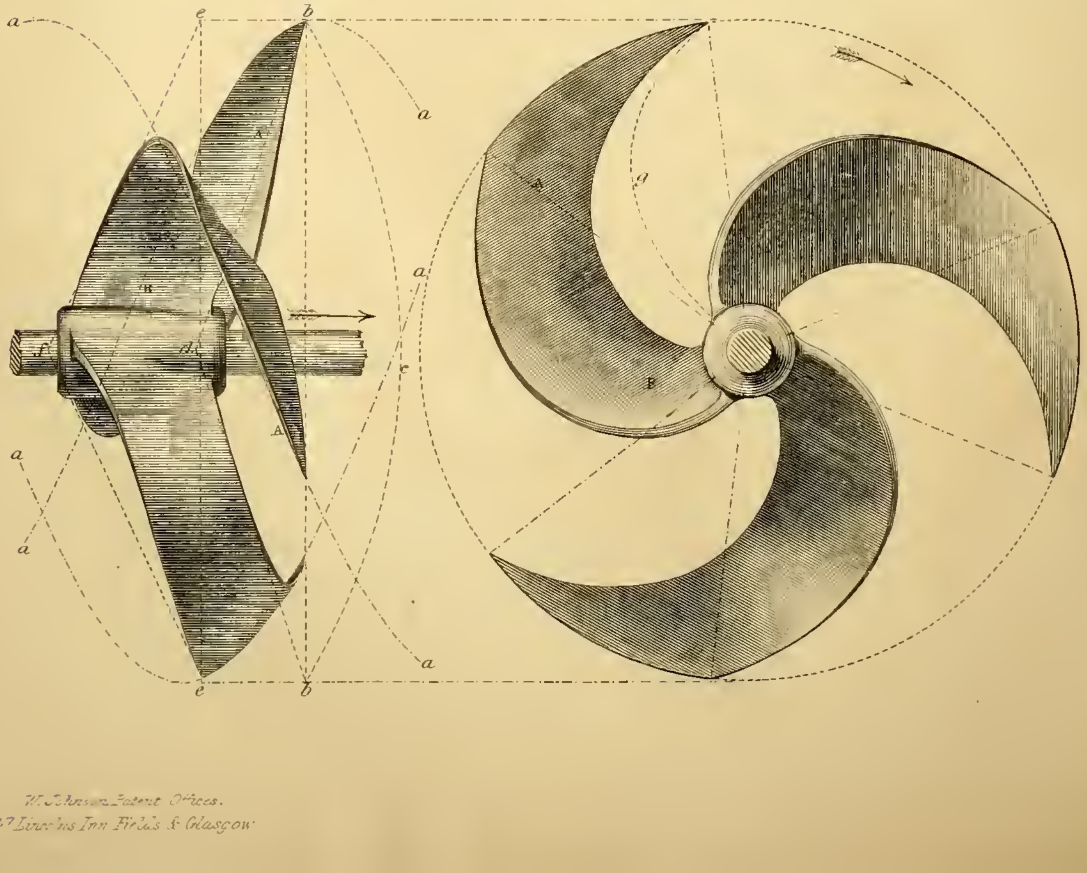


Fig. 3.



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W. Johnson Patent Offices.
47 Lincoln's Inn Fields & Glasgow.

AL SCREW PROPELLERS,

PATENTEE.

W.

Vol. VIII.

Fig. 2.

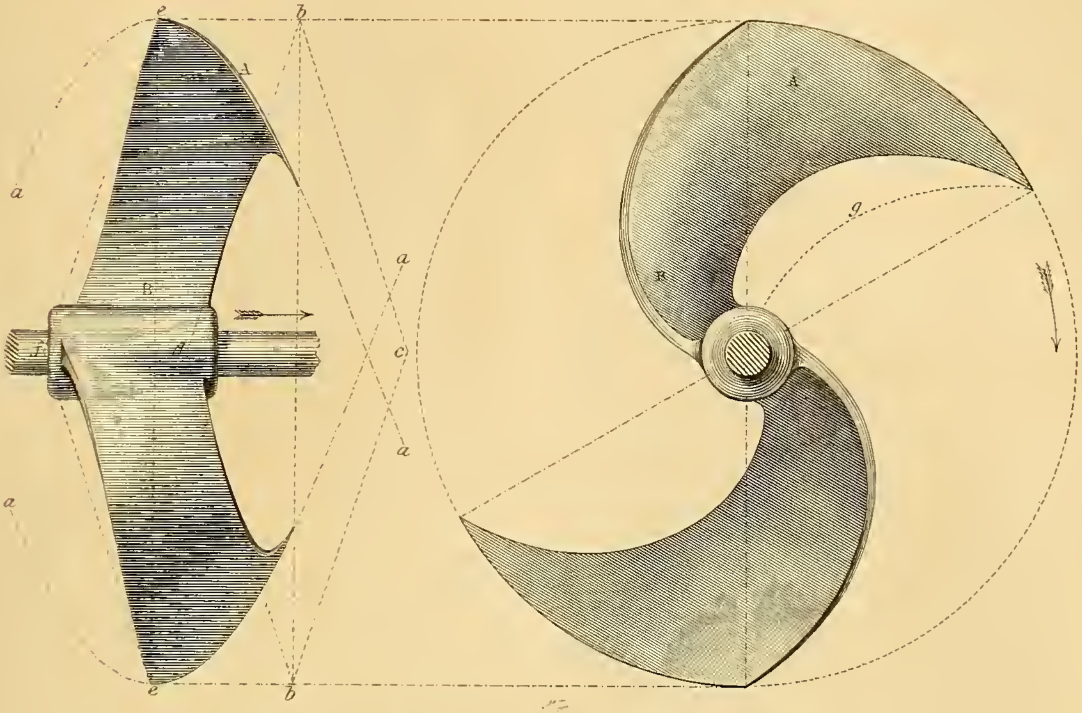
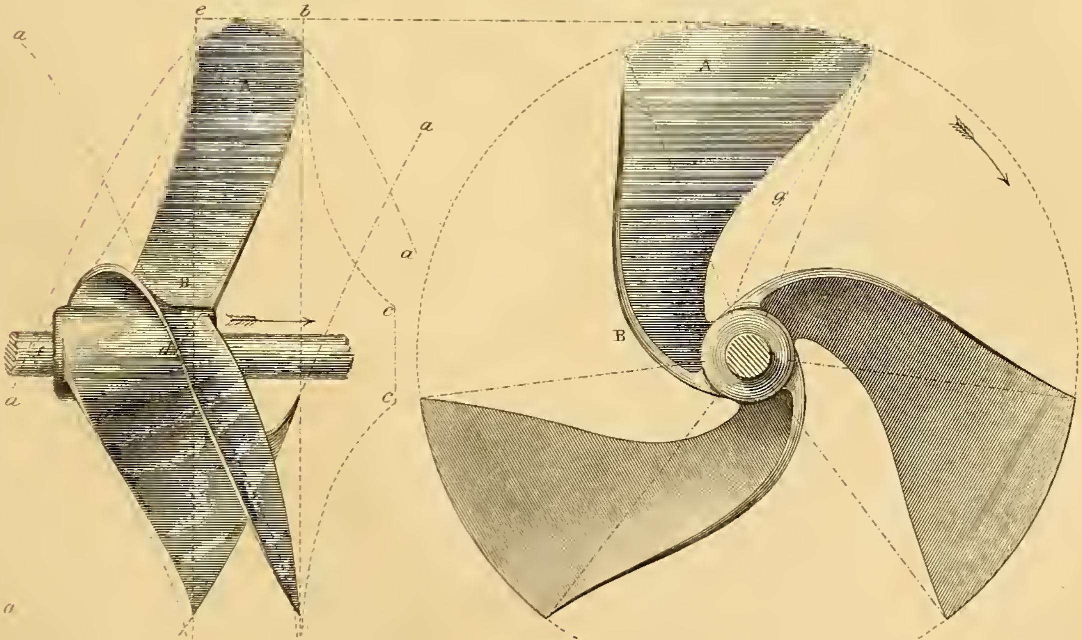


Fig. 4.



FOOT.

Printed by Mackay & Kirkwood,

ADVANCE-BLADED CONOIDAL SCREW PROPELLERS.

EDMUND HUNT, PATENTEE,
GLASGOW.

Fig. 1.

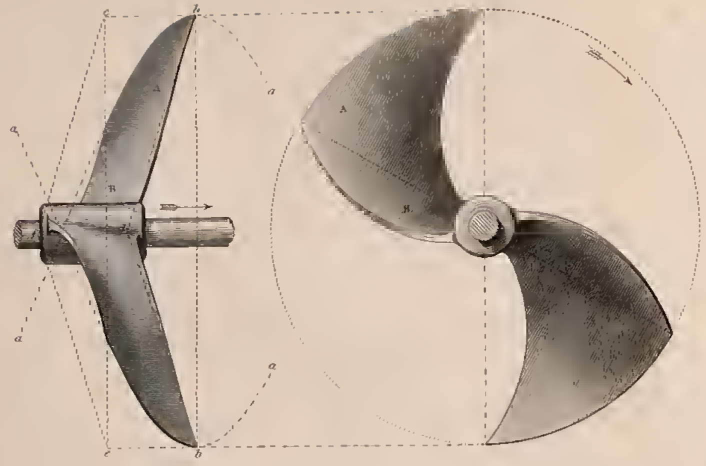


Fig. 2.

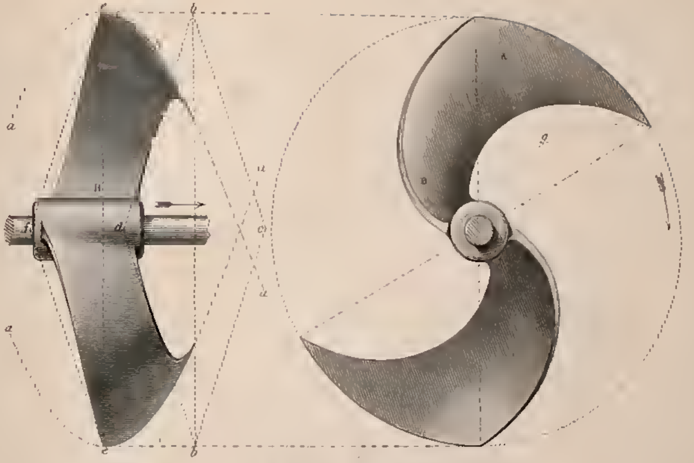


Fig. 3.

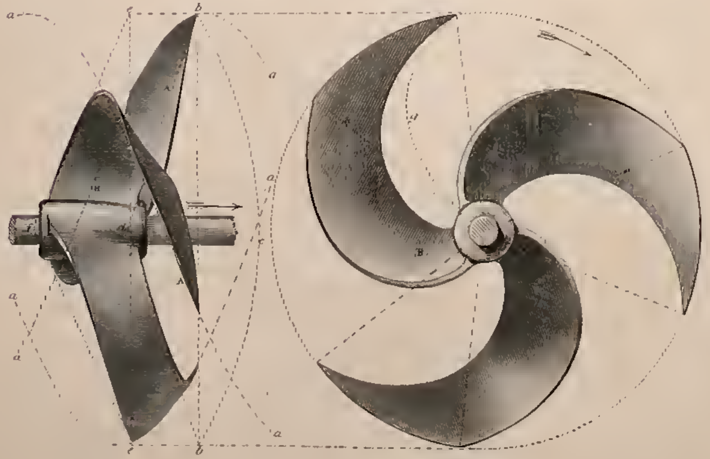
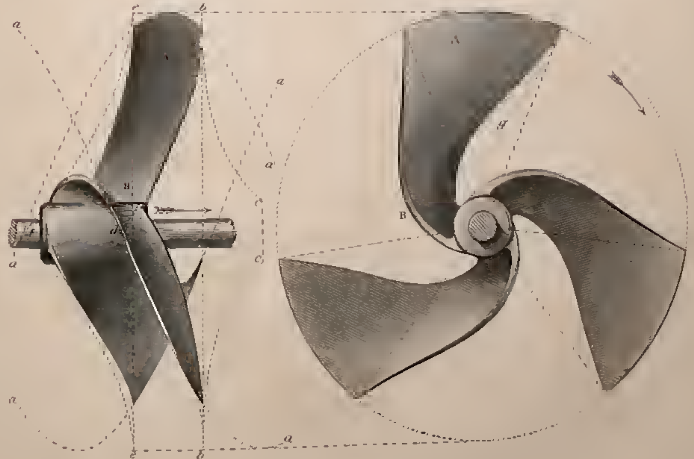


Fig. 4.



Scale.
$\frac{1}{4}$ INCH. = 1 FOOT.

W. Johnson & [illegible] Offices
47 Lincoln's Inn Fields & Glasgow

Printed by Mackay & Kirkwood

THE GREAT EXHIBITION AT PARIS, 1855.

FROM OUR OWN CORRESPONDENT.

IV.

The open space at the centre of the Annexe, where we left our readers last month, is arranged round about with comfortable seats; and the wall spaces above the seats are decorated with beautiful mechanical drawings by Armengaud and Le Blanc, some of these drawings representing the machinery used in the gutta percha and caoutchouc manufactures. Amongst the drawings are examples of Petitcolin's splendid engravings of mechanical subjects, some of the specimens being no doubt very well known to our own readers. We may here mention that there are a considerable number of mechanical drawings and engravings appropriately dispersed over this part of the Exhibition, advantageously filling up odds-and-ends of wall space. The only noticeable exhibitors of these, however, are the parties whose names we have just given. A set of drawings by Armengaud, of an extensive flour-mill, are worthy of particular attention, for the faithfulness with which the details are rendered, and for the excellent general effect of the whole. Of these drawings, there are in the Exhibition one or two photographic copies on a reduced scale, which have all the appearance of having been taken from the objects themselves.

Before leaving the central space, we must notice four varieties of French hoisting-cranes, placed at the four corners. There is also in one corner of this space, a model of a clothes-washing machine, by Lejeune of Paris. We have already mentioned, that the French collection of machinery occupies the quarter of the Annexe immediately to the west of the central space. About half of this quarter is occupied by machines in a state of rest, with the exception of a few minor curiosities worked by water. There are also several machines at rest, filling up inconvenient spaces amongst the machines in motion, towards the extreme western part of the space. Of the machines at rest, the first that attract our attention are some unwieldy-looking locomotives. Amongst these are a goods engine from the Orleans Railway, on six wheels coupled together, with inside cylinders, but with external valve casings, eccentrics, and valve gearing; a powerful engine by A. Kœchlin of Mulhouse, on six wheels—four being coupled together—with external cylinders, but with valve casings, eccentrics, and valve gearing inside; and an engine from the Paris and Lyons Railway, constructed on Engerth's system. Near these engines is a monster, constructed by Gouin of Paris, on Blavier & Larpent's system. This engine has six wheels, two small leaders, and four, each 9 feet 4 inches in diameter. The boiler is cut up into a number of nondescript parts, the axles of the wheels passing through amongst them, whilst the cylinders are placed on a level with the axles, and have a stroke of 30 inches. In this direction the French are going beyond us with a vengeance. Gouin has another locomotive near at hand, of more respectable proportions. It is a tank engine, with external cylinders and valve gearing; the pistons 14 inches in diameter, with a stroke of 18 inches. Near here, against the southern wall, Gouin has also a "Nasmyth" steam hammer, which has a very top-heavy and shaky appearance. On the same side are several malleable iron plates, of various forms, from the Creusot Ironworks, some of the plates being 4 inches thick, and of the kind employed in the construction of the sea-batteries. The Creusot Company show drawings of their works. Near the last are a collection of boring tools and apparatus, and models of the same, by Degousse & Laurent. These tools will be thought clumsy and antiquated by those who have seen Mather & Platt's improved system, which takes us such a stride in advance in this direction. A lathe, by Deshayes of Paris, is very complete, and shows some good workmanship. Passing on, we notice, along the southern side, a curious tortoise-shell comb-making machine; a paper machine by L'Huillier; a spinning-frame from Rouen; a silk-winding machine, by Lemesre of Roubaix; a wire card-making machine; a large lathe, by Munier of Rouen; a small planing machine, by the same hand; an 18 horse-power stationary engine, by Danguy of Paris; a 4 horse-power engine, by Hollet of Paris; a model of Boutigny's diaphragm boiler for carrying out his "spheroidal" system; a "Nasmyth" steam-hammer, by Cavé, with the block placed obliquely; a grain washing and drying apparatus, by Baron; and Rolland's kneading apparatus for the manufacture of bread. Turning towards the centre, we find a pair of direct-acting screw-engines, of 20 horse-power, by Gaché, ainé. In these engines the cylinders lie inclined at angles of 45° above the shaft, the pistons working out below in slides, and with short direct connecting rods. There is nothing new in the design, which has several defects. The engines are, however, well made. A larger pair, of almost the same design, and by the same maker, are placed at a short distance from these last. Some spinning machinery from Rethel finds a place here, and near it is a large coal-cleansing apparatus, used in the manufacture of artificial fuel from fine coal dross, which is extensively carried on in France. On the north side there is a portable tubular steam boiler by Durenne, constructed on what he terms the system of "inverted currents," the interior of the boiler being spaced off, so that the water gradually passes from the coolest to the hottest part of the heating surface, at which last part the steam is given off—a good idea, but carried out in too complicated a manner by M. Durenne. On the same side are a pair of small marine paddle-engines, of 80 horses power, in which the cylinders are horizontal, the air-pump levers forming the parallel motion, and at the same time working a secondary shaft, upon which the eccentrics and expansion-valve cams are placed. Near these engines are some more boring tools, arranged in a kind of trophy, and also—very much out of place—a trophy of tanned cow-hides. We have next to particularly notice the articles exhibited by Froment & Co. of Chartres, consisting of a beet-root press and flour-mill apparatus. The latter forms a conspicuous object in the centre of the floor, the stones being mounted upon a staging, which is reached by stairs, whilst the turbine by which the stones are driven is below. There are five pairs of stones, arranged in a circle, and driven by frictional contact, the gearing being so contrived that any single pair may be disconnected without disturbing the rest. A grain-washing and drying apparatus is also shown, and the whole collection is very complete, and well set off by excellent workmanship. To the north side of the flour-mill details, is an apparatus for moulding toothed wheels without a complete pattern. The circular rim is first scooped out in the mould material by means of a revolving cutter, of sufficient extra diameter to take in the teeth; and separate cores, made in a separate little wooden mould, are placed in position by hand, to form the spaces between the teeth. This very imperfect and not very original system is invented by Louvrié, and as there is in the English department a recently-invented apparatus for doing the same thing, we have at least one pair of comparable data, for judging of the progress in practical invention made by the two countries. We shall refer again to this when treating of the English machine.

We now take note of a number of steam-engines at rest; namely, a stationary 15 horse-power one, by Martin of Paris, with a horizontal cylinder; a stationary double-oscillating cylinder engine, of 18 horse-power, by Boyer; Pascal's compressed-combustion boiler and engine, with two horizontal cylinders and air-forcing pumps; a double cylinder, 30 horse-power stationary, by Lecouteux of Paris; a 25 horse-power one, by Henrieux of Rouen; various other stationary engines, by Schreiber & Tresel of St. Quentin, Frey of Paris, and Gavrian of Moulins-Lille; Powell of Rouen, a 30 horse-power, marked sold; Casalis of St. Quentin, a Woolf's engine, of 12 horse-power; Scott of Rouen, a 30 horse-power beam engine; Rouffet of Paris, a 15 horse-power stationary engine, and a 4 horse-power farm engine; Durenne of Paris, a farm engine; and by Cail of Paris, a variety of horizontal cylinder, blowing, and other engines. We cannot do more than mention a great variety of ingenious novelties, such as Tailfer's system of moveable furnace-bars; Fauconnier's plaster-mill;

Roux's electro-dynamic motor; a hydrostatic hammer, from Besançon, with oblique block and overhanging slides; Turck's impulsive steam hammer, in which the steam not only lifts the hammer, but adds its impulsive action to the descending stroke; Gavrian's centrifugal sugar drainer; Picot's beautiful models of a machine for sawing veneers, and one for agitating champagne wines; Lecuyer's hand-drilling tools; an elevating apparatus, on the lazy-tongs principle; lathes, tools, and patterns, from the imperial schools of Chalons; a steam pump, from the imperial school of Angers; a vertical drilling machine, from the Aix school; a die press for making heddle mails or eyes; a model of Burt's wood-preserving apparatus; Faure's apparatus for testing flour; Marquise's station buffer, an ingenious compound of joints and springs, the horizontal strain being converted into a vertical one, by a species of bell-crank buffer head; a travelling railway crane from the same works; Cail's excellent three-roller sugar press, with horizontal-cylinder engine and gearing; and Seyrig's centrifugal sugar apparatus. Here we come to another locomotive, one by Cail, with outside cylinders and inside valves and eccentrics, and with six wheels. Cail has also several other things about here; a screw-press for beet-root; a pair of unfinished locomotive wheels, showing a mode of dovetailing the parts together; a large distilling apparatus; an apparatus for macerating beet-root on Schuzenbach's system; a slotting machine, copied from English types, but slender-looking; some small planing machines, of different sizes; apparatus for rectifying alcohol, and apparatus for draining moulded sugars by exhaust, a system invented in France contemporaneously with the same thing by Mr. Welsh of Greenock. Near this large collection are, a press, involving an extremely powerful movement, consisting of a double toggle, or elbow-joint, and screw; an engraving machine; and a comprehensive engine-turning lathe. Proceeding onwards, we notice a powerful lathe by Polonceau, for turning railway wheels, made for the Orleans Railway, and a powerful slotting machine, by Varrall, Middleton, & Elwell, of Paris. And this brings us to the noisy region of the machinery in motion.

The mechanical arrangements for driving the machinery are very complete. A first motion shaft is carried along the centre of the building upon a series of cast-iron pedestals, which have evidently been got up in great haste, for they are far from presenting that beauty of form which we expect to see in objects of French construction. In point of fact, they are decidedly inelegant, and detract considerably from the appearance of that part of the building. A heavy-looking gangway runs along the top of these pedestals, which are 25 to 30 feet high, to give access to the bearings and pulleys of the first motion shaft. This shaft is driven by several steam-engines, which, whilst exhibiting themselves, are usefully employed in aiding other things to show their capabilities. The several machines in motion stand on each side of the central first motion shaft, and they receive their driving belts from it. The boiler or steam-supply arrangements, however, are not nearly so good as the gearing. The boilers are placed entirely in the hands of French engineers, and we heard loud and frequent complaints amongst all the attendants connected with the machinery in motion. There was never steam enough to set above a quarter of the engines and machines at work, and the exhibitors had to make arrangements amongst themselves, so that each might get his fair share of what steam was to be had; the engines each taking a five-minutes' mouthful by turns, and remaining idle a great portion of the time during which they ought to have been showing off their good points. As a matter of course, the French section of machines in motion managed to get the lion's share of such steam as could be got up. Some English engines, which required a pretty high pressure, could scarcely ever get agoing; whilst, in the French section, many of Flaud's high-pressure engines were constantly at work. Flaud is the champion in France of the very high-pressure and quick-speed system of steam-engines, and he also applies small separate engines to single machines, just as Nasmyth does with us. There is a great deal to be said both for and against both systems. As to having separate engines for separate machines, or even for separate flats of a mill, it is a question whether the attention and repairs required with a multiplicity of small engines, beyond that of a single large engine and its shafting, would not more than overbalance any anticipated advantages.

One of the first things we notice in the moving machinery section is a small shaping machine, driven by its own horizontal oscillating cylinder, with a simple valve motion, by Béchu of Paris. Next is an engine at rest, with Maldant's valves, on a system proposed in England some years ago, but possessing many defects. The valve slides between two valve faces, one containing the cylinder ports, and the other the steam and exhaust ports, the valve not being covered by any casing. A single horizontal-cylinder engine here, by Revollier of Paris, attracted deserved attention, from the steadiness and smoothness of its motion. Its valves are of the tappet class, worked by an ingenious but simple double bell-crank lever movement, and it is provided with link-reversing gear. The same exhibitor has also a steam hammer, of the common type. Beaumont & Mayer exhibit a steam generator, the heat in which is produced by the friction of revolving surfaces, involving, we should think, an immense waste of power, and not likely to be useful except in very few cases. The French sewing-machines are shown here in full operation, the pretext of their being machines in motion being taken, we suppose, for placing them here, so as to attract a few ladies to this part of the Exhibition, otherwise devoid of attraction for them. Hermann has close by a neat table engine, with side-rods and cross-head below for working the shaft. There is also a chocolate-mill, with granite rollers, by the same maker. Amongst a few things at the side here, and not in motion, are, a printing-machine from Rouen; a printing-roller engraving machine, by Chesneau of Rouen; a machine for making hooks and eyes, by Pellerin of Paris; a small horizontal slotter, or shaper, by Dyckhoff of Bar le Duc; a dividing engine, by Ribon; two or three well-made watchmakers' lathes; and some cylinder castings, by Vivane. In motion, we have a machine for manufacturing chocolate, and for weighing it, and making it up into packages, by Pelletier of Paris; machinery for preparing and combing hemp and flax, by Ward of Lille; a typographic press for printing two colours at once, by Dutartre of Paris; a typographic press, by Nicolais of Paris; H. Marinoni's press, capable of throwing off 15,000 impressions per hour; an envelope-folding machine, equal to 4000 per hour, by Rabatté & Rettig of Paris; printing presses, by Voirin and by Alauzet; a lithographic and lithochromic press, by Huguet & Vaté of Paris; and a lithographic press, by Dupont—a very shaky affair. We next come to some more machines not in motion, such as, a sawing machine, by Damey; paper-cutting machines and embossing presses, by Poirier; a machine for perforating metal sheets, by Calard of Paris; a lithographic press, by Brisset of Paris; a model of an engine, by Isoard, to make 1000 strokes per minute. and to be worked by steam, of a pressure equal to 30 atmospheres; Légal's vacuum sugar-boiler; a steam gold-beating machine; Baudet's veneer-sawing machine; and Deshorde's case of indicators, of various kinds. A machine which attracts considerable attention at this part of the French space, is Périn's ribbon-sawing frame. A narrow serrated steel ribbon is passed over pulleys, and driven at the rate of about 4000 feet per minute, and is made to cut out the most intricate ornamental forms in wood, with scarcely any loss of material, and with a facility and rapidity truly astonishing. Our readers will remember that Mr. M'Dowall, the saw-mill engineer of Johnstone, has proposed and tried a similar thing in this country. Near this machine are various tools for working in wood, chiefly for producing ornamental forms; and there is an ingeniously arranged machine for cutting out knee timbers for shipbuilding purposes, by Normand of Havre. Latour, frères, show a very ingenious machine for cutting out and sewing boot-tops, and for completing the boots; also a machine for weaving the stuff—a species of plaited fabric—used for the boot-tops, the whole set being driven by a 6 horse-power rotatory engine, by Moret of Paris. Some machine tools by Calla of Paris, and a model of Westrup's conical flour-mill, both at rest, are near here. Then come a portable engine in motion, by Calla; and a long planing machine, by Decoster of Paris. In this last machine, the tool head is moved by an endless chain, which arrangement, though it possesses some advantages on the score of convenience, involves the serious defect of unsteadiness. This machine is of a size to take in a very large piece of work, being, perhaps, the largest tool in the Exhibition. Flaud, whom we have already mentioned, attracts our attention again. He puts forward his high-pressure and quick-speed system in every available form. He generally uses Larivière's governor, which is a recent invention, and is put upon a great many of the steam-engines in the French department, being evidently a great favourite. As well as we could ascertain from observation, and in the absence of any description of the internal arrangement of this regulator, it appeared that the throttle valve was kept in constant motion, opening to allow the steam to pass for each stroke, like an expansion cut-off valve; and that, when the rate of the engine varied, the governor action took effect by increasing or diminishing the extent of the oscillations of the valve, which was not connected directly to any moving part of the engine, but to a small pumping cylinder with a weighted piston.

Turning to the side of the building again, we notice, at rest, some paper-cutting, embossing, and ruling machines, and apparatus for paging books and papers; a splendid slotting machine (not much inferior to the best English examples), from the Graffenstaden workshop, from which place are also some other well-made machine tools; a punching machine, by Durenne, on Fairbairn's system of hollow-wrought iron-plate framing; two or three varieties of vertical drilling machines, by Boutrey of Paris; and Bourdon's various well-known inventions of the pressure-indicator class. Bourdon has a fine engine at work here, a horizontal-cylinder stationary one; and near it is a surcharged steam-engine, by Cazalat of Paris. Further on at the side are a collection of filters, by various makers, the most remarkable of which are Duplany's filter bottles, useful things for travellers and pic-nic parties, as, by immersing them up to their necks in a dirty stream, a bottleful of pure water is obtained in a few minutes, having found its way into the interior through the permeable material of the bottle, leaving all impurities behind. We have already engraved and described an example of this class of filter, as patented by M. Mathieu.* Passing a horizontal-cylinder direct-acting blowing engine, we come to Nepven's stationary engine in motion, pumping up the Seine water for the use of the Exhibition, by means of Letestu's pumps. Letestu exhibits various kinds of pumps, and in one of them a very simple and ingenious bucket valve is adopted. This valve consists of a shallow inverted cone of leather, slit radially, the edges of the slits being bevilled. When the bucket descends, the leather flaps collapse, leaving a very clear passage for the water; but in rising they expand, and fill the pump barrel, preventing the passage downwards of the water. Hereabouts is a large collection of pumps, and other water apparatus, by various exhibitors.

Turning next towards the central space, we find before us the more important of the French manufacturing machines contributed to the Exhibition. Amongst these are Windsor Brothers' extensive and complete spinning machinery from Lille; carding engines and wool-spinning machinery, by Mercier of Louviers; carding machinery, by Dupont of Amiens; and Lacroix' flax-combing machine. These are all at work. Near them, but not at work, are Piat's machine for cutting wheel-teeth, such as bevil, skew, and other difficult forms; several circular knitting looms and plaiting machines; hand-wrought check looms, with horizontally-shifting shuttle-boxes, one loom constructed for ten shuttles; and several hand-wrought Jacquard looms. Passing a well-executed model of 30 pairs of stones for grinding porcelain material, driven by a water-wheel, we come to a loom for weaving on Acklin's paper-Jacquard system; near which are several other varieties of Jacquard looms, and amongst them some models of machinery used in the caoutchouc manufacture, by Couturier of Thernes. We next notice Sehlumberger & Co.'s fine and important collection of spinning machinery, arranged in the central space and at work; and Kœchlin's cotton heater-and-scutcher, and carding machinery. Near the last are Harbly of Paris' machine tools, lathes, slotters, and others; roller-engraving machines; small steam-hammer; and a cam and spring action forge-hammer. Then come spinning machinery, by Stamm of Thann; a beater-and-scutcher, by Grun of Guehwiller, Haut-Rhin; a draw-bench, by Danguy of Rouen; a cotton carding engine, by Clénet, worked by one of Flaud's single-machine engines; a calico-printing machine, by Kœchlin of Mulhouse; spinning machinery, by Muller of Thann, Haut-Rhin; Stéhélin & Co.'s spinning machinery; and Fargot's horizontal-cylinder stationary engine in motion. This is a slow-speed engine, and gives its contribution of driving force to the main machinery shaft by means of an immense belt-drum, combined with the fly-wheel. The governor of this engine communicates its regulating action by means of a pair of opposed bevil wheels, loose on the governor spindle, and in gear with a bevil wheel on a horizontal spindle, the rotation of which acts on the throttle valve. The backs of the bevil wheels on the governor spindle are coned, to fit two hollow cones connected to the governor balls, so as to rise and fall with them. When the balls rise, the lower cone drives the lower bevil wheel by friction; and when the balls fall, the lower cone falls away from the lower bevil wheel, and the upper cone, coming into contact with the upper bevil wheel, drives this last, of course giving a reverse motion to the horizontal spindle. This is one of a class of governors which are too slow in action, a defect which might in the present instance be remedied, by arranging the horizontal spindle to screw itself longitudinally through a tapped bush, which bush could be at once shifted by the governor balls, by means of a bell-crank lever. Proceeding onwards, we observe Carpentier's hank-winding machine, which has been described and illustrated in the *Practical Mechanic's Journal*;* two or three fire-engines; a confectionary machine; a model of a chain-paddle water-power apparatus, as used on the Rhone at Lyons, by Roman & Seon; some more fire-engines; water-meters; a miniature turbine in a pipe, for driving single spinning spindles—not a bad idea; two or three turbines; a horizontal reaction water-power wheel, showing an evident loss of power in the circular motion given to the waste water; a flour-mill, connected to a turbine, but not in motion, by Roy & Laurent of Dijon; and a beautiful model of a flour-mill, by Darblay of St. Maur.

The following articles merely still remain to be noted in the collection of French machinery; namely, a pretty set of Jacquard models; carding and spinning machines, by Parpaite of Reims; Michel's beautiful silk doubling and spinning machine; Collette's large horizontal disc-carding machine, which attracts a great deal of attention from the perfect and humanlike way in which it does its work; Vigoreux' spinning machinery from Reims; carding and spinning machinery used in the manufacture of hemp, from Brest; and Chevalière's ingenious machine for cutting stone. In this last-mentioned machine, a wire is made to run at a high velocity across the stone, cutting through the stone very rapidly, sand and water being dropped upon it to aid its action. With power equal to one horse, the hardest stones can be separated at the rate of a square foot per hour, which is about three times as much as can be done by the same power in the ordinary way, and the renewal of the wire only costs a tenth of the expense required to keep ordinary tools in working condition.

The English machinery occupies about one-half the remaining space in the Annexe, the Belgian, Austrian, and Prussian machinery being to the east, and that of the United States, Holland, and Sweden to the west of the English space. We shall next month complete this series of articles, by describing the noticeable contents of these various remaining spaces.

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* Page 69, Vol. VI., *P. M. Journal.*

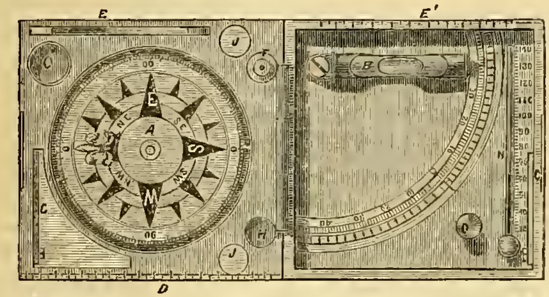
* Page 60, Vol. VIII.

"METRA" FOR GEOLOGISTS AND MINERS.

Whilst popular treatises bring each of the advances of science within the circle of "common things," efforts are making "pari passu" to simplify the means or the instruments by which observations may be taken. Many scientific instruments are already domesticated in the halls of England, and we may fairly expect that as each merchant captain records his observations for Lieutenant Maury's behoof, so travellers will go provided with measures of the powers of the earth and of the air, for the benefit of some geological or other compiler.

A new instrument attracted much interest at the late meeting of the British Association, as offering to the traveller and engineer the means of taking most of those measurements which it is useful to record. Without sacrificing the strength necessary for constant use, or interfering with the accuracy of each portion, this instrument contains, in a brass case, three inches square, and little more than one inch thick, eleven different instruments. The traveller in distant lands can ascertain by its means the temperature, the force of the wind, the latitude, the position of the rocks, or survey and map his route. The geologist can determine and draw the direction and amount of dip of the rocks, the angles of cleavage and crystallization, the temperature of springs, or examine, by a plate of tourmaline, the bottoms of pools or shallow depths along coast lines, otherwise invisible to the eye. The miner, for whom chiefly this little instrument is intended, can moreover survey and level the roof or floor of his workings, and requires only a pencil to map them upon paper. It contains also a magnifying lens, and a measure of the wires in a Davy lamp. The miner can ascertain the temperature of the air under ground, and discover whether the ventilation is deficient, or if the foul air from abandoned workings leaks into the life-supporting current. By the anemometer, a thin plate of mica suspended so as to be frictionless, he may measure the quantity of air brought in, and determine whether it is proportioned to the wants of the mine. Beneath the transparent mica, a table of constants exhibits the weight of gases, liquids, and solids, besides some thirty measures and formulæ for steam, boilers, engines, ropes, and air. To exhibit the ingenuity displayed in this pocket instrument, it is sufficient to mention that it contains a clinometer, goniometer, level, double compass, plotting scales of various kinds, and an anemometer. Under the name of "Metra" it gained a medal at the last exhibition of the Society of Arts.

Fig. 1.



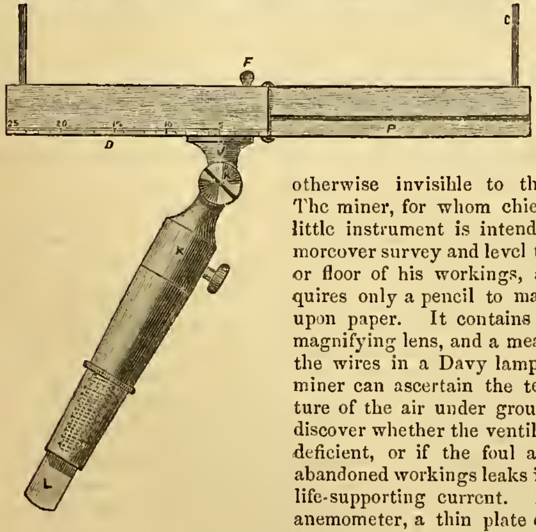


Fig. 2.

It was contrived by Mr. Herbert Mackworth, one of her Majesty's inspectors of mines, for his own use in underground observations.

The accompanying figs. 1 and 2, represent the plan and side view of the metra when open and ready for use. A is the double compass, and B the level. The arc is graduated in degrees and in inches fall per yard. C the sights, D the scales, E the goniometer arm, and E' the goniometer scale; F the plummet, G the lens, with a telescopic slide to measure the wire gauze; H the tourmaline, J the pivots on which the instrument stands, K are the two joints of the brass leg, by which the horizontality of the instrument can be obtained; L is a flat chisel point for entering joints of rock or masonry. This end unscrews, exposing a wood screw, M, by which the leg can be secured to a tree or a stand. N is the thermometer, O the screw which secures the top and bottom of the instrument together. Beneath the bottom, P, are placed the anemometer and the table of constants. The adjustments of the metra possess several novelties, with the view of shortening the operator's work. On this head we may allude to the plan of laying down the surveys on paper, without the aid of anything but a pencil, by first adjusting the north and south line of the plan by the compass, and fastening the paper down by weights. The compass then serves as a protractor, and by the engraved scales the distances are measured off. This method saves calculation and ruling parallel lines, and obviates some instrumental errors. The inventor states, that any dial or theodolite can be fixed to a scale, and used in a similar way as a protractor. The instrument is made by Mr. J. D. King of Bristol, as well as a simpler form in boxwood, adapted for geologists.

DISCLAIMERS IN PATENT CASES.

By the Authors of the Patentee's Manual.

It is well-established law, that a patent which includes two inventions, of which one is not new or not useful, is altogether invalid; and that if the patent is confined to a single invention, any material part of which has either of these defects, the patent is likewise invalid. The fatal effect of an inconsistency between the title and the specification is also well known. To remedy a law which in very many cases bore unjustly upon patentees, a clause was introduced into the Act 5 and 6 Wm. IV., c. 83, by which a patentee is empowered (by leave of the Attorney or Solicitor General, in case of an English patent; or of the Lord Advocate or the Solicitor General for Scotland, in case of a Scotch patent; or of the Attorney or Solicitor General for Ireland, in case of an Irish patent, certified by his fiat and signature) to enter a disclaimer of either the title of the invention or of the specification, stating the reason for such disclaimer; or with the like leave to enter a memorandum of any alteration in the title or specification (not being such disclaimer or alteration as shall extend the exclusive right granted by the said letters patent); and such disclaimer or memorandum being filed with the specification, is then to be deemed part of the letters patent, or of the specification, in all courts. It is, however, expressly provided that the disclaimer, or memorandum of alteration, shall not be receivable in evidence in any action or suit pending at the time it was filed, except in a proceeding by *scire facias*. The effect of this clause has been to check the bringing of *scire facias* to repeal patents, except where the vice complained of goes to the essence of the invention, and to every part of it. The patentee being enabled not only to amend the title and specification by disclaimer, but to put his disclaimer in evidence at the trial, it may be that the prosecutor's case is altogether cut away from him. In such event he may be called upon to pay the patentee's costs, the payment of such costs being the condition of the bond given by him at the commencement of the suit, in case the patent shall not be cancelled by means of the writ of *scire facias*, or proceedings thereunder. Leave to put the bond in suit must, however, be first obtained from the Master of the Rolls or the Attorney-General; and neither functionary is likely to grant such leave, when the prosecutor stayed his proceedings as soon as he received notice of the disclaimer by which the invalidity of a patent was cured. See what fell from the judges in the *Queen* v. *Mill*.

In the case of *Perry* v. *Skinner*, 1837 (2 Meeson and Welsby, 471), the Court of Exchequer decided that the 83d chapter of 5 and 6 Wm. IV. has no retrospective operation, and that a person is not liable to an action for infringing a patent which was originally voidable, but which was subsequently amended by disclaimer under this statute, where the alleged infringement was committed previous to the entry of the disclaimer. Notwithstanding the positive words of the statute, that the disclaimer should be deemed and taken to be part of the letters patent or of the specification, in all courts whatever, the judges—considering that to adhere strictly to these words would have the effect of introducing the inconvenience of making parties wrong-doers by relation—sheltered themselves under the rule of construction, that the precise words of a statute may be modified, if they lead to absurdity or inconvenience.

In the case of the *Queen* v. *Mill*, 1850 (10 C. B. R., 379), the Court of

Common Pleas expressed itself dissatisfied with the decision of the Court of Exchequer in *Perry* v. *Skinner*. "The statute of William IV.," said Mr. Justice Williams, "gives us, in very plain and unambiguous language, that we are to deem and take the disclaimer to be part of the specification. It seems to me that we cannot help holding that such disclaimer is receivable in evidence." "There is nothing absurd," said Jervis, C.J., "in supposing the legislature intended that a specification and patent, after disclaimer; should be treated as if originally in the altered condition, and that an infringer of valuable parts of a patent should not be allowed to justify such infringement, because the patent or specification had been defective, although it was subsequently cured by a disclaimer. I think, on the construction of the Act, the disclaimer must be read as part of the patent from the time when the patent is granted." Maule, J., thought that, when the statute was closely considered, the inconvenience apprehended by the judges of the Court of Common Pleas could not arise. For, as the leave of the law officer must be obtained before filing a disclaimer, this must be considered an adequate means of preventing inconvenience, and the public would thereby be properly protected. The Act declares that whenever the disclaimer is enrolled, it is to be deemed and taken to be part of the specification; "that is to say," said the learned judge, "that those who have to consider what is or is not part of the patent and specification, are bound to deem and take it as part of the specification, although it was enrolled subsequently." And this construction, he thought, was clearly confirmed by the proviso at the close of the first section of the Act.

In the Irish case of *Carmichael* v. *Comb*, tried before Chief Justice Blackburne in 1851 (reported in the 18th volume of the Repertory of Patent Inventions), the facts were these:—The plaintiff obtained a patent for a machine in May, 1846, and in due course he enrolled his specification, which, however, was defective, by reason of its claims being too extensive. In January, 1849, he filed a disclaimer, and thereby rendered his patent valid. In the meantime, however, the defendant obtained a patent for a similar machine, and enrolled his specification. In an action for infringing the patent of 1846, the defendant argued that it was void, by reason of the defective specification, until the filing of the disclaimer; and this instrument having no retrospective operation, the defendant's patent, obtained before the filing of the disclaimer, was a sufficient answer to the action. But the Chief Justice considered the specification and the disclaimer as forming one instrument, and that the facts afforded the defendant no defence.

It might, therefore, be considered as authoritatively decided, prior to the passing of the Patent Law Amendment Act, 1852—1st, That a disclaimer might be given in evidence in an action brought for an infringement committed previous to the filing of the disclaimer; that is to say, at a time when the patent was invalid, when the action was commenced after the filing. And, 2d, that a disclaimer might be given in evidence in a proceeding by *scire facias*, whether it was filed before or after the issue of the writ. However, as two courts of equivalent authority had given adverse decisions upon one of these questions, it was thought proper to interpose. By the 39th section of the Patent Law Amendment Act, 1852, the provisions of the 5 and 6 Wm. IV., c. 83, and of 7 and 8 Vict., c. 69, as to disclaimers and memoranda of alteration, are directed to apply to patents under that Act. The same section declares that no action shall be brought upon any letters patent which, or the specification of which, has been altered by disclaimer or memorandum, in respect of any infringement committed prior to the filing of the disclaimer or memorandum, without the express permission of the law officer. It is further declared, that the filing of any disclaimer or memorandum of alteration, in pursuance of the law officer's leave, shall, except in cases of fraud, be conclusive as to the right of the party to enter such disclaimer and memorandum.

The judges having decided, in the case of *Holmes* v. *London and North-Western Railway Company*, that a patent for an improved turn-table for railway purposes was invalid, because the patentee had not limited his claims to the combination of the parts of the machine, but had described, and was therefore considered to have claimed, the several parts, some of which were old, the assignee of the patent applied to the Solicitor-General for leave to enter a disclaimer of the separate parts of the turn-table, so as to confine the claim of invention to the combination of parts forming the whole apparatus. The Solicitor-General (1853), after hearing counsel in opposition, as well as for the applicant, granted the leave sought for, upon the terms of the applicant undertaking not to bring or prosecute any action or suit against certain parties, in respect of any turn-tables made or used by them before the date of the disclaimer. *Macrory's Patent Cases*, 31.

In the matter of *Bateman and Morris'* patent (Macrory's Patent Cases, 116), an application was made (1854) to Bethell, S.G., for leave to alter the specification, so as to make it disclaim all the parts of the invention, and claim only the combination. The Solicitor-General said that he should require to see from the specification itself that it had not been intended to claim the separate parts, but their combination only. Finding some indication of an intention to claim the apparatus as a whole, he gave the patentees permission to reject certain words in the claiming part of the specification which were inconsistent with such a construction. When some distinct and separate part of the invention is clearly old or useless, then there is no difficulty in excising it from the specification by a disclaimer. But where this is not the case, the entry of a disclaimer before a trial at law is a matter of doubtful policy. In the reported cases of the allowance of disclaimers, trials at law had previously taken place, wherein the difficulties and objections to be obviated had been pointed out.

Every disclaimer which will have the effect of extending the exclusive right granted by the patent will be void by the language of the Act. For example, if the specification showed that the parts were claimed, and not their combination, then a disclaimer which affected to reject the parts, and to insert a claim for the combination alone, would be bad, inasmuch as this would be an attempt to extend the original privileges of the patent. By the 5th sect. of the 7 and 8 Vict., c. 69, the right to enter a disclaimer or to amend is given to an assignee who has acquired the whole interest in the patent. When the patentee has assigned part of his interest only, the patentee and assignee must join in making any disclaimer or alteration.

Under the language of that part of the section which enacts that "no objection shall be made, in any proceeding whatsoever, on the ground that the party making such disclaimer or memorandum of alteration had not such authority in that behalf," it was held that the disclaimer of a patentee who had assigned all his interest in the patent could not be objected to.—*Wallington* v. *Dale*, 7, *Exch. Rep.*, 888.

The application for leave to enter a disclaimer or memorandum of alteration, with respect to patents granted subsequent to the Amendment Act of 1852, must be made at the Patent Commissioner's Office, and it is then referred to the proper law officer. The petition must be impressed with a stamp of £5. Persons having adverse interests may lodge caveats (requiring a £2 stamp) at the office, and they are then entitled to notice when the application is heard by the law officer. Leave having been obtained, and the law officer's fiat issued, the disclaimer or memorandum of alteration is simply filed at the office, no enrolling being now required.

THE APPLICATIONS OF ELECTRICITY.

Dumas, the French chemist, has been delivering a popular lecture, or what we may venture to call an *éloge*, on electricity and galvanism at Paris. We have thought that our readers may like to see, in these pages, a free translation of it, with the omission of a few passages.

A stick of bees-wax (said the philosopher), on being briskly rubbed, attracts dust; fur, over which the hand is passed, bristles up and crackles, giving forth sparks; a loadstone turns towards the north; two pieces of wire of different metals excite the nerves of the tongue by their contact; a piece of zinc, suspended by a brass wire and placed in a solution of lead, gives rise to the tree of Saturn, the cause of so much curiosity to the chemists of old. Now, in relation to these phenomena, investigation has brought to light the following principles:—

The agitation of the particles of dust proceeds from a power so potent as to threaten the supremacy of steam as an originator of motion. The sparks given out from the fur is a species of lightning, and the noise accompanying them may be called thunder. By exciting these sparks in a peculiar way, a light is obtained, which is surpassed in brilliancy by the sun alone. The loadstone, ever mysteriously pointing towards the north, is the basis of the art of navigation. It has discovered two vast continents—Australia and America; and, after enabling us to traverse every sea, the power that animates it, serves, for the purpose of intellectual communication, to bind continent with continent by means of a slender chain. The trees of Saturn, objects of empty curiosity to our ancestors, are produced by the principle which guides the process of electro-plating. Finally, the contraction of the muscles, produced by the contact of two metals, gave rise to the Voltaic pile, or battery, one of the most admirable of scientific instruments, and the soul of most modern discoveries.

How often have humble facts, simple ideas matured by a reflecting mind, led to magnificent discoveries! Sagacious calculations and brilliant theories spring apparently out of nothing, as the richest tissues of silk are made by a worm.

After Franklin and Volta came Oersted, who discovered the action of galvanism upon magnetism; Ampère, who detected the action of the galvanic fluid upon itself; Arago, who perceived the action of turning bodies upon the magnetic needle; and Faraday, who investigated the phenomena of induction.

In the savage state, man's only servant is his own strength, assisted perhaps by some faithful animal. In time, the winds and the element of water are made to yield him aid; and then, but long afterwards, steam is his slave, and by this he can work miracles.

Who will dare to predict the future course of electrical science? Already thoughts are instantaneously conveyed from place to place by means of this subtle fluid, and at the will of the operator it may be converted into a docile force—into heat, light, or a powerful chemical agent.

As a generator of heat, the galvanic battery can be made an irresistible furnace. Hitherto certain bodies have been regarded as infusible, but on the application of the battery all these have either been melted or volatilized. The most refractory metals and earths are converted into liquids, and vanish in vapour. The chief obstacle to the industrial application of this powerful furnace—the application of it, for example, to the working of platinum—is less perhaps the expense than the difficulty of regulating its too powerful effects; for platinum is volatilized when it should only be melted.

As a means of illumination, electricity may be turned to vast account. Work may be carried on at night as well as by day, as is the case at the Napoleon docks, where eight hundred workmen receive light by night for about twenty francs. Is it not a matter of the greatest importance to obtain a light, unequalled in intensity, at such an inconsiderable cost? Moreover, air is not wanted for its support. It may be obtained in close vessels; and it will exert its illuminating power in the lowest mines, and at the bottom of the sea. It burns the longer and the more brightly when plunged into the most irrespirable gas.

As a chemical agent, the galvanic battery, to which we owe electro-metallurgy, has given a new metal, aluminum, into the hands of industry. Nay, though we knew that the diamond was only crystallized charcoal, it was only of late that charcoal has been converted into diamonds—and this was effected by the same apparatus. The works of Elkington, and other electro-platers, are seen everywhere. Various processes are employed to deposit a thin coating of metal upon another piece of metal. Elkington's process, however, does not consist in the employment of a battery, but in the use of magnets of soft iron. A boiler heated by charcoal produces the steam required to set in motion a machine which turns the iron intended to receive the magnetism from the magnets. This magnetism is converted into electricity, which, in its turn, acts upon large vats, and compels the solutions they contain to deposit their gold or silver upon the bronze submitted to their action. Heat, mechanical, electrical, chemical forces; such is the series of transformation which have to be gone through before the work is accomplished.

Electricity is sometimes employed as a mechanical agent. M. Froment has, for some time past, been driving his workshops by means of an electrical engine, which, from its regularity of motion, simplicity, and economy, he feels assured has an incontestable superiority over every other motive power. Moreover, electrical breaks have been applied to railway carriages. Then there is M. Bonelli's electrical loom set in motion at a small expenditure of electricity, and with a great diminution of manual labour. Finally, there is Professor Davy's electrical engine, which has been exhibited in motion, and which, at an original cost of 1000 francs, and a daily expense of 2 francs, possesses already a power of a 1-horse engine, and which, in the opinion of its young inventor, is susceptible of great improvement.

Electricity, which conveys thought so rapidly, that it can travel four times round the earth in half a second, can likewise convey light, chemical and mechanical forces, and even heat. Whenever this marvellous power is required to act, it is always in readiness; if its cessation is required, it can be done in a moment, and without cost; if required to move to another place, there are no obstacles which cannot be overcome, for it can descend valleys, ascend mountains, cross rivers, pass through the midst of cities, and finally arrive at its destination with its energies unabated.

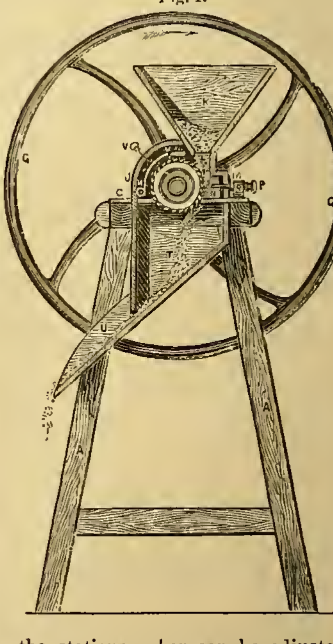
The scheme has suggested itself, of placing small motive powers in the cottages of workpeople, and having the great generator of electricity in the middle of the village, from which a supply might be conveyed to every workman in his own home, thus enabling the father of a family to perform his work by his own fireside, and in the midst of his children, the daughter working under the mother's eye. Such a plan would give to the inhabitants of the country the advantages possessed by factory workmen, without the corruption and disorder, the loss of health and morality, incident upon their living in a large town.

TINDALL'S GRAIN CRUSHING MACHINE.

One of the modern pieces of enlightenment which is gradually dawning upon the agricultural or stock-feeding mind, is the practice of feeding cattle upon crushed or bruised grain. All grain-eating animals are, for the most part, bad masticators of their hard food. In fact, they commit the same indiscretions which beset their superiors, and to a far more extravagant extent; when hungry, they bolt their mouthfuls. Hence, a great portion of the grain passes through the stomach whole, and under such a condition is not only utterly useless as a nourishing substance, but positively injurious to the animal, for it involves the expenditure of the gastric juice upon a mere softening of the husk, without extracting any nutriment. These are powerful reasons for recommending all stock-owners to use mechanical crushers.

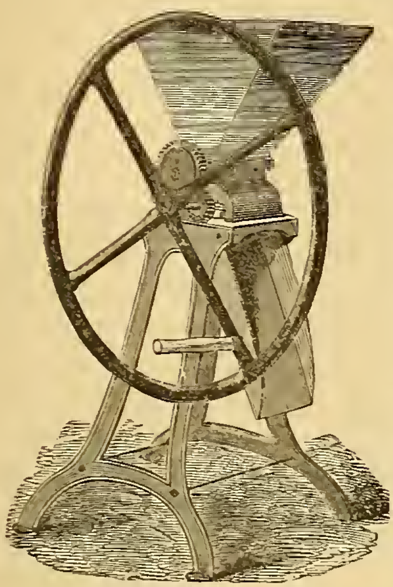
Mr. Lorenzo Tindall, formerly of Scarborough, and now of the Sherwood Iron Works, Mansfield, has recently introduced and perfected a simple but peculiarly effective crusher, which we engrave under two forms in the present article. Fig. 1 is a sectional elevation of this implement, as originally contrived, with a rough wooden frame. The frame consists of the four inclined timber legs, A, suitably connected by cross pieces near the bottom and at the top, by the square-head platform frame. This top frame carries upon it an iron base plate, C, firmly bolted down, and having cast upon it two journal pedestals for supporting the main horizontal driving-shaft. This shaft is actuated by a winch-handle attached at one end, whilst it carries, at the other end, a fly-wheel, G, to steady the action. The bruising cylinder is of cast-iron, formed with parallel inclined angular ribs, I, like long ratchet teeth. It is contained within the wooden case, J, resting upon the plate, C, the two square flat ends of the cylinder being set to bear close up to the opposite inner sides of the case. This bruising case is rectangular on one side and curved on the other, to conform to the cylinder, and it is surmounted by the feeding hopper, K, the lower end of which opens into the upper side of the bruising case by a thoroughfare at L, extending across the entire width of the chamber. The part of the latter beneath the hopper is formed with a projecting rectangular recess, M, to contain the stationary metal bruising bar, N, formed with end flange pieces, having elongated transverse holes in them. These holes are to receive bolts fitted with nuts on their upper ends, for the purpose of tightening the bar firmly in position, when set to the required relation with the cylinder. This adjustment is effected as required, with great nicety, by means of the thumb-screws, P, turned and fitted with plain collars, to work freely in the solid eye-bearings, Q, cast on the plate, C. The screwed ends of the thumb-screws pass through the side of the part, M, of the bruising chamber, and enter screwed apertures in the bar, N, so that, when the bar is to be set, the holding-down nuts are slackened off, when their slots will allow of the horizontal traverse of the bar, N, as urged back or forward by the action of the thumb-screws. In this way the stationary bar can be adjusted with its acting edge as close to the cylinder's periphery as may be necessary, with the greatest possible accuracy. The bar, N, is curved out along its inner side, to coincide at its upper part with the opening, L, from the hopper, and thus allow for the descent of the grain into the space between the curved surface of the bar and the cylinder. In this modification of the bar, N, its lower edge is formed with a series of serrations, or duplex angularities, or projections. Hence, as the cylinder rotates, its angular ribs successively carry down portions of the grain, which cannot escape from the curved recess of the bar, N. As the grains are thus taken down, they are brought into forcible contact with the serrations or saw-like teeth of the bar, N, and as these serrations or teeth are set close up to the periphery of the cylinder, each individual grain is crushed and torn asunder in passing through between the fixed and

Fig. 1.



stationary surfaces. As the bar, N, is set accurately parallel with the cylinder's axis, not a grain can escape without being completely torn or severed, so as to expose its interior. The discharged grain, in its completely bruised condition, falls from the crushing action down into the receiving channel, T, and thence along the inclined discharger, U, to whatever receptacle may be placed beneath. To keep the cylinder clear of adhering particles of grain, a horizontal brush, V, is fitted up above the cylinder. This brush, which commands the entire length of the cylinder, is screwed to the free projecting end of a carved lever piece, the opposite bottom end of which is set on a stationary stud centre, X, carried by the plate, C. At Y is a small handle projecting through the curved cover of the bruising chamber, and hinged at its inner end to the lever piece of the brush. This is for adjusting the brush to apply the handle, having cross pins, notches, or other contrivances, for setting the brush at the intended height.

Fig. 2.



In using this machine for crushing grain of all kinds, nothing more is necessary than to supply the grain to the hopper or feeder, K, the discharge from which is regulated by a slide inside the hopper, and then turn the winch-handle. The stationary bar, N, is set nearer to or further from the crushing cylinder, to suit the kind of grain or other substance which is to be crushed or reduced, and this adjustment, as hereinbefore shown, can be easily and accurately effected. Another means of regulation or adjustment exists in the ribs of the cylinder, and the sensations of the stationary plate, both of which are to be made of the proper pitch or relative fineness to suit the matters to be subjected to their action. Although particularly well adapted for reducing corn for horse-keep, machines of this class will most effectually grind linseed, barley, pease, beans, coffee, and other granular matters. The machine may be driven either by a winch-handle set directly upon the cylinder spindle, or by a similar winch set upon the shaft of a pinion which gears into a spur-wheel on the crushing spindle, as in the perspective view, fig. 2, where the machine is carried by a neat iron frame.

THE TEMPERATURE OF THE EARTH.

Why is the earth neither warmer nor colder than we at present find it? What are the causes that preserve its equability of temperature? These are questions to which it is not easy to give a full and explicit reply, and there are few subjects of scientific research presenting room for greater diversity of opinion. At the same time, certain leading facts have been ascertained, which enable us to form some idea of means by which uniformity of warmth is secured.

Some experiments have led to the conclusion, that the temperature of space surrounding the globe is not only below the freezing point of water, but even below the zero of Fahrenheit's thermometer. There must, therefore, be a continual loss of heat by radiation into the empty void around. If this refrigerating cause were left unopposed, it would speedily seal up both sea and land in a firmly frozen mass. We find, however, on the other hand, that the sun is uninterruptedly pouring forth his heating rays; and these, if acting alone, would soon dry up the ocean, and cover the earth with dust and ashes. Here, therefore, we find two antagonistic forces, either of which, if acting alone, would prove destructive, so admirably adapted to each other, that a moderate warmth is secured, and comfort and enjoyment diffused. So uniform and continuous, moreover, has this adaptation been, that, if the researches of geologists do not mislead us, there has been but little change in the temperature of our globe since the annals of animated creation began.

When we remember that the range of temperature within which plants and animals can live is so very limited, that a comparatively trifling alteration of the average warmth of the earth would prove fatal to the larger proportion of the organized creatures which it contains, and that any considerable change would entirely destroy the whole of our cosmical arrangements, we see at a glance the wisdom of the system to which we have now referred.

The means by which the heat of the tropical regions is modified, and the cold of the polar circles is mitigated, through the agency of the currents that are found in the air and the ocean, are equally deserving of remark. The air, heated in the equinoctial parts of the globe, rises to the upper regions of the atmosphere, and thence flows northward and southward to the poles. The water of the ocean, exposed to the influence of the tropical sun, is by a similar cause directed to a similar course. The heated water of the West Indian seas, flowing northwards along the American coast, forms the current known to seamen as the "gulf-stream;" and after diffusing a genial warmth over many a bank teeming with aquatic life, is deflected to the shores of Britain, and gives us a warmer climate than is found in any other place of similar latitude.

The inclination of the axis of the earth to the plane of its orbit, to which we owe our summer and winter, is another means by which uniformity of temperature is in some measure secured. In consequence of this peculiar arrangement, that part of the globe in which the solar rays fall perpendicularly downward, and where their influence is consequently most intense, is continually shifting, and the northern and southern hemispheres are made to rejoice alternately in the return of summer.

Another instance of beneficent adaptation, in connection with temperature, may also be noticed. When moisture is thoroughly dissolved in air, the transparency of the air is not affected. The rays of the sun, therefore, falling on the earth, and the heat radiated from the earth into space, pass through an unclouded sky without interruption. But whenever the moisture is condensed into mist or cloud, the rays that fall upon it, from whatever quarter they may come, are not transmitted, but reflected. The passing clouds obscure the sun; that is, they reflect, and do not transmit his beams; and a precisely similar effect is produced on the rays of heat emitted from the earth. A clear day is, consequently, warmer than a cloudy one; but a clear night, other things being equal, is colder. When, therefore, the rising sun dissolves the morning mists, he, in fact, opens the way by which his cheering influence may reach the ground; and when, at his setting, the vapours are again condensed, a covering is formed, which intercepts the heat emanating from the earth during the night, and prevents it from flying off into space. As the tender mother sends out her little ones to sport in the sunshine, while the sky is bright and clear, but brings them home at eventide, and closes the door, and spreads the coverlit over them when they retire to their slumbers—so the ever-watchful Parent of all opens the curtains of the earth during the daytime, that the busy myriads of his creatures may enjoy the cheering beams of the sun; but closes them again during the night, that the wearied sons of toil may be protected from cold while they partake of needful repose.

KENNEDY'S CYLINDER AND PISTON WATER-METER.

(*Illustrated by Plate* 181.)

The water-measuring apparatus invented by Mr. Thomas Kennedy of Kilmarnock, and introduced on more than one occasion into the pages of this *Journal*, has passed into the hands of "Kennedy's Patent Water Meter Company," who have established large works in Kilmarnock for the commercial manufacture of the meters on an improved model and most extensive scale. The formation of this active company may be accepted as good evidence—first, that the want of a fair water-meter has at length been substantially recognised in the country; and, secondly, that Mr. Kennedy has satisfied himself that he is in a position to have that want supplied.

As our system of water supply for large cities has gradually developed itself, until, as in the case of Glasgow, we go to a reservoir thirty miles off, and spend the better part of a million of money in bringing down from it the needful stream of purity, the necessity of adopting some metrical guide for its distribution and use has also grown into prominence. Hitherto, indeed, we have been content with the crudest guesses at fluid quantities, and nothing like a system of registered measurement can be said to have existed. It is not too much to say, that in the Kilmarnock apparatus we have a complete answer to all demands which are likely to be made, either on the large scale of the manufacturer, or the smaller one of the private household consumer.

Fig. 1 is a front elevation of the meter. Fig. 2 is a side elevation with the casing removed, to show the internal mechanism, and with the measuring cylinder in vertical section. Fig. 3 is a front elevation of the upper part of the apparatus, but with the counting mechanism and front plate removed, to show the details by which the valve or cock is worked. Fig. 4 is a plan of the apparatus with the covering casing removed, and figs. 5 and 6 are vertical and horizontal sections through the waterways and cock. The main fluid cylinder, A, into which the water is passed, is set vertically on a suitable base, its upper end being covered by a plate, in which is the stuffing-box for the rod, B, of the piston, C, to pass through from the interior of the cylinder. The projecting end of this piston-rod has attached to it a rack, D, in gear with a pinion, E, the spindle of which turns in bearings in a bent bracket, F. The rack is kept in gear with the pinion by means of a small antifriction roller carried by the bracket, and between which roller and the pinion the rack passes. The spindle of the pinion, E, is in the same axial line as a fourway-cock, the plug or key, G, of which has upon it a pair of bent lever arms, H, arranged for the weighted tumbler, I, to fall against in either direction. The fluid supply is derived from the pipe, J, communicating with the shell of the fourway-cock, from the two opposite ports of which the passages, K, L, pass down to the upper and lower ends of the cylinder, A, respectively, the passage, K, being curved to one side to clear the inlet passage, J. The fourth passage, M, opposite to the ingress pipe, is the discharge outlet. As delineated in the figure, the piston, C, is supposed to be rising, water entering beneath it, whilst that which is above it is passing off. As the piston rises it lifts the rack, D, and, turning the pinion, E, causes a catch, N, fixed to the back of this last, to lift up the tumbler lever, I. This tumbler lever is carried loosely on the spindle of the pinion, E, and, as the piston reaches the top of its cylinder, is brought up to its vertical position, and falls over suddenly to the other side. In falling over, the tumbler lever, I, strikes one of the bent arms, H, of the cock plug, G, and, altering the position of this last, causes the water which was below the piston to escape by the outlet pipe, M, whilst fresh water enters above the piston, and causes it to descend. The descent of the piston turns the pinion, E, in the opposite direction, so as to lift up the tumbler lever, I, and to finally throw it over to the other side, thereby again altering the cock plug. And in this manner the mechanism continues to act, the cock plug being altered as the piston reaches the termination of its stroke either up or down. The dial indications of the water passed through this meter are derived from the spindle of the pinion, E, this spindle having fast upon it a small bevil wheel, O, in gear with reversed bevil wheels on a horizontal spindle, P. The bevil wheels on the spindle, P, are fitted on this spindle with ratchet wheels, arranged so that the spindle always turns in one direction, whether the bevil wheel, O, is turning in one direction or the other. The spindle, P, has upon it a worm which is in gear with the first wheel of a train of counting wheels, by which the pointers on the dials, Q, are moved, to indicate hundreds, thousands, and larger numbers of gallons. The piston, C, is made of wood, so as to be buoyant in the water, and it is fitted with metal flanges, R, at its top and bottom. The piston is made to fit water-tight within the cylinder by means of a ring, S, of india-rubber, which rolls between the surface of the piston and the internal surface of the cylinder as the piston moves up and down, the piston being of a sufficient length to allow of this rolling action, by which friction is avoided. When the piston is at the bottom of the cylinder, it rests upon a flange, T, which has an india-rubber ring fitted upon it to form a tight joint, and so prevent the passage of water past the piston, when this last is resting upon it. A similar india-rubber ring, U, is fitted into the top cover of the cylinder, to form a tight joint when the piston is at the top of the cylinder.

It is obvious that the actual piston stroke of this meter determines, to the highest possible pitch of nicety, the quantity of water passing through the cylinder on its way from the supplying mains to the consumer's receiving vessels. No matter at what rate the water flows through the meter, the indications will be unvaryingly accurate, as, should the piston exceed, or fall short, of its intended movement, that departure from the true action will be duly measured by the indicating dial. Whatever head pressure the water possesses on entering the measuring cylinder, is felt in an undiminished state upon the service pipe—a feature which is of the highest importance, as the user ought always to have the power of distributing his supply to the highest level due to the initial head pressure, quite irrespective of the presence of all measuring contrivances.

Mr. Brunel, to whom this meter was some time ago submitted for practical trial, has started the idea of a new use for it, as novel as it is valuable. This is the adaptation of it to marine boilers, and he has arranged for the supply of twenty of them for the boilers of the enormous combined screw and paddle steamer, now building by Messrs. Scott Russell. Mr. Brunel's object is, by fitting a meter to the feed-water pipe of each boiler, to ascertain, in a manner which leaves nothing to be guessed at, what is the real performance of every individual boiler in the ship's series. Under like circumstances, of course, each boiler should accomplish its own just and fair share of the work; but it not unfrequently happens that the evaporative value of each boiler differs materially from that of its neighbour. According to ordinary practice, this is not so easily made out; but with a meter keeping watch and ward over each boiler, the matter is made perfectly clear, and the delinquent boilers can then be brought up to their proper work. The meter indeed becomes a steam boiler indicator, and, as Mr. M'Dowall of Johnstone has happily remarked, "it will do for the steam boiler what Mr. M'Naught's instrument has done for the steam engine."

SCREW PROPELLERS.

E. Hunt, *Glasgow.*

(*Illustrated by Plate* 182.)

It has long been understood that the most efficient portion of a screw propeller is the outer part of the blade, and that the action of the central part is rather injurious than otherwise. Many attempts have been made to get over this presumed defect. According to one plan, the blade has been cut away towards the centre, so as to leave only an arm to carry the outer part of the blade; but in practically carrying out this plan, it has been found necessary to make the arm of an increased thickness, so as to be strong enough to carry the blade; and the increased bulk of the arm is as injurious to the propelling action as the part for which it is substituted. In fact, experience seems to show that the best form in which to dispose the quantity of metal necessary to give sufficient strength to the central part of the blade, is that of a continuation of the outer part. Mr. Griffiths attempts to get over the difficulty by filling up the central part of the propeller with a large sphere, and with his screw he has obtained as good results as have been yielded by the common screw. This, however, only proves that the action of the central part of the common screw is defective; it is, in fact, the substitution of one bad thing for another. It is obviously a bad thing to make a propeller unnecessarily drag through the water an immense sphere, one-third of its own diameter in size. If a propeller with such a drag equals the common screw in its performance, the direct conclusion is, that the latter is defective to an extent equal to this drag. A further conclusion is, that if we can obviate this defective action of the common screw without substituting the spherical drag, we shall obtain a superior propeller.

In order to cure the defective action in the common screw, we must first analyse it. A great portion of the power, which is said to be lost in using screw propellers, is dissipated in causing the recession of the water from the blade, and anything which facilitates this recession may be considered as occasioning a loss of power. If the propeller could impel the water backwards in parallel lines, or in converging lines, so as to accumulate it behind it, as it were, the water would not as easily recede as if it were impelled in such a manner as to spread out in divergent lines. Now, the central part of a common screw blade impels the water in divergent lines; that is, it has a centrifugal or divergent action. In the common screw, this action is chiefly injurious in disturbing the water acted upon by the outer and more efficient part of the blade, and in causing it to recede more easily. The blade, in fact, acts on broken water, and does not meet with that resistance to recession which undisturbed water would yield. Looking at the action of the common screw in this light, a facile way of improving it, and getting rid of the defect to a great extent if not altogether, at once suggests itself, namely, by placing the outer portion of the blade as much as possible in advance of the central part. This arrangement of the blade forms the main feature of the advance-bladed screw, invented and patented by Mr. Hunt.

Several screw propellers have been tried, in which the acting surfaces have been curved or inclined backwards, with the view of obviating divergent or centrifugal action; but these propellers have been so shaped that the outer and more efficient portions of their blades lie more in the path or sphere of the centrifugal disturbing action of the central portions, thus neutralizing any benefit that might be expected from the backward inclination or curvature of the acting surfaces.

In some modifications of his advance-bladed conoidal screws, Mr. Hunt combines a curved or inclined acting surface with an outline form of blade, wherein the outer and more effective part of the blade is in advance of the central part, thereby obtaining the increased effect due to the curvature or inclination of the acting surface, undiminished by the disturbing action of the central part.

The screw propeller represented in fig. 1 of our plate, in side and end elevation, the latter as looking on the acting face, is delineated as having applied to it only one of the improvements comprehended under the patent. It is exactly like the common screw, as far as regards the kind of acting surface given to it; for, if this surface is cut by a plane passing through the shaft, the line of intersection will be a straight line, *b b*, at right angles to the shaft, as is equally the case in a common screw. Instead, however, of the blade being cut straight down to the shaft on its entering and back edges, as in the common screw, it is made with these edges gradually sloping backwards from the outside towards the centre. In other words, the entering or front edges of the blades are such as will lie on the surface of a cone, indicated by the dotted lines, *b d b*, whilst the back edges are such as will lie on the surface of a similar cone, *e f e*. By these means the outer portions, A, of the blades are thrown in advance of the central portions, B, and are thereby enabled to act on water undisturbed by the latter. The arrows indicate the direction in which the screw propels ahead, and the dotted lines, *a a*, indicate the helical paths of the circumferential edges of the blades. The same letters refer to similar parts in the several figures. In the screws represented in figs. 2, 3, and 4, the advancing of the outer portions of the blade is combined with a backward inclination of the acting surface. Thus, in fig. 2, the line of intersection, *b c*, which a plane passing through the shaft would make with the surface of the blade, is a straight line inclined backwards from the shaft, and not at right angles to it, as such an intersecting line would be in a common screw. This makes the acting surface slightly hollow, and gives the blade an increased hold on the water, without, however, in the least degree, impeding its recession in the proper direction. In the propellers represented in figs. 3 and 4, the line, *b c*, of the intersection with the acting surface of a plane passing through the shaft is curved, instead of being straight as in fig. 2. In fig. 3, the line, *b c*, is more inclined backwards towards the outside, whilst in fig. 4 it is more inclined backwards towards the centre. It is considered that the kind of propeller blade represented in fig. 3, will be better adapted for vessels with proportionately small power, whilst, for vessels with full power, the modification represented in fig. 4 will be more suitable. The invention is, of course, applicable to screws with any number of blades. The screws represented on the plate are of uniform pitch; that is to say, they would work through solid close-fitting nuts; they may, however, be made with an increasing or expanding pitch if desired. The blades may be strengthened to any extent without affecting their efficiency, by adding material to the central part of the back edge; that is to say, by making this part longer on the shaft the increased length being added to the after edge.

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RECENT PATENTS.

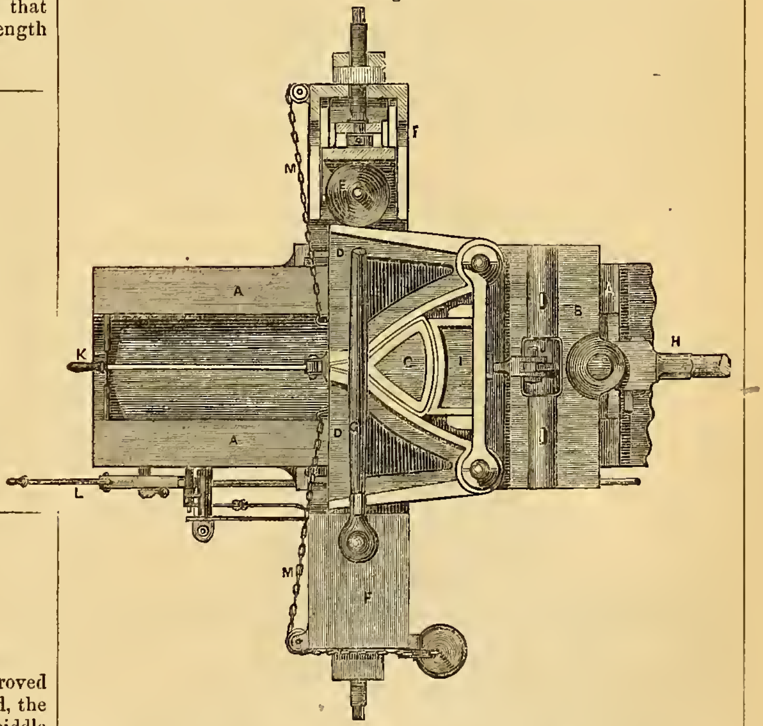
RAILWAY WHEELS.

A. Craig, *Paisley.—Patent dated October* 31, 1854.

In the general class of wheels, for the manufacture of which improved machinery, comprehended under the present patent, is constructed, the spokes are formed by bars of wrought-iron bent into triangles, the middle of the bar lying against the inside of the tyre, whilst the ends extend to the boss, and form the spokes. The object of one portion of the patented improvements is to bend these spoke-bars into the requisite shape. According to one modification of the machinery, a traversing platform, or carriage, is arranged upon a bed plate in a similar manner to that of a planing machine, being made to traverse by means of a crank, or any other suitable movement. On the traversing carriage is fixed a block, formed to the shape of the inside of the triangle; that is to say, so as to fill the inside of the spoke-bar when bent into shape. Opposite to the circumferential or curved side of the central block, is a block for shaping the outside of that portion of the spoke-bar, and this block is capable of approaching to or receding from the central block, being suitably fitted in slides for the purpose. On each side of this sliding block, is a block for acting on the outsides of the ends of the spoke-bar. The two side blocks turn horizontally upon pins carried by the traversing carriage, and they act upon the spoke-bar by turning against it, and gradually bending it into the proper shape, the bar being put into the machine in the form of a straight bar. This action is effected by the traverse of the carriage, and by means of a pair of antifriction pulleys carried by the stationary framing. The side blocks are made triangular in shape, and when the carriage is traversed between the stationary pulleys, the outsides of the blocks come in contact with the pulleys, and are thereby made to turn in upon the spoke-bar, and to gradually bend it into shape. On introducing the bar, the slide block is shifted back to allow it to be entered in a straight form, and when the machine is in action, this block is made to advance by a self-acting movement, so as to give the requisite bend to the bar at that part. A self-acting movement is also provided for throwing the machinery out of gear as soon as the shaping of the spoke-bar is effected; and when completed, the spoke-bar is thrust upwards by suitable mechanism, so as to be easily removed. It is obvious that the frame carrying the shaping blocks may be stationary, and the requisite bending action may be effected by causing the side pulleys to traverse, these pulleys being mounted in a suitable frame. According to another modification, the side blocks may be connected directly to, and worked by cranks. Or, again, the side blocks may be worked by hand, in which case they may have sockets formed in their ends to receive hand levers, and when the ends approach each other they may be connected by a screw or screws, by means of which they may be still further compressed or held together. The slide block for acting on the outside of the circumferential portion of the spoke-bar, may be adjusted up against the bar by means of a screw arrangement, or it may be connected to the other moving parts so as to act simultaneously with them.

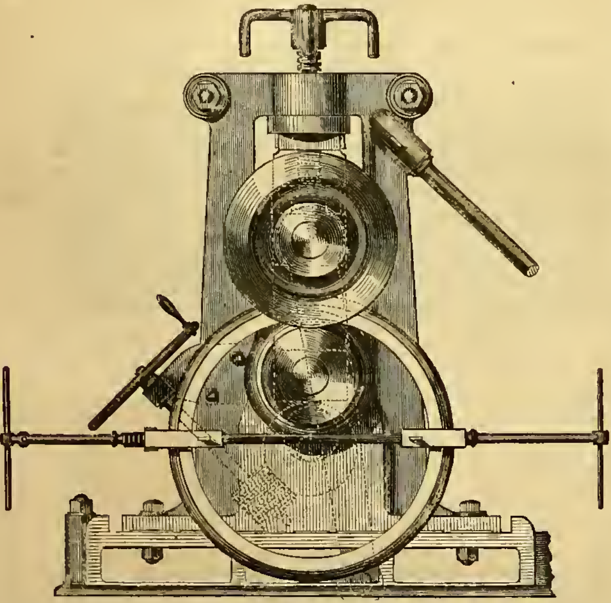
Fig. 1 of our engravings is a plan of one modification of the spoke-bending apparatus. The framing consists of a rectangular cast-iron sole plate, upon which are set up two transverse end standards, and an intermediate transverse standard, which support a horizontal cast-iron bed plate cast with the two dovetailed slide-rest flanges, A, upon which fits and slides the table or frame, B. The machine is driven by a large pulley, loose upon a horizontal shaft, carried in bearings on the sole plate. The pulley is formed with, or fixed upon, an elongated boss, upon which is a friction pulley, embraced by a friction strap screwed up tightly, so as to transmit the driving power, but at the same time so as to slip, if any inordinate strain occurs in the working of the machine. Motion is com-

Fig. 1



municated to the shaft by means of a clutch-box fitted upon it with a groove and feather, and capable of being shifted into or out of gear with the friction strap, either by hand, or by the action of the machine itself, as hereinafter more particularly described. A bevil pinion, keyed upon the horizontal shaft, drives a bevil wheel, fast upon a vertical shaft, mounted in suitable bearings; and on this shaft is keyed a pinion, which drives a spur-wheel upon a second vertical shaft, carried in suitable bearings near the rear end of the machine. By means of this gearing, a slow, powerful movement is obtained for working the sliding frame, B, back and forwards. This motion is communicated from the spur-wheel to the frame by means of a connecting-rod, H, jointed at one end to a pin bolted to one of the arms of the wheel, and at the other end to a pin passed through a double eye in the back of the frame, B. On the frame, B, is carried a block, C, which is held down by bolts at its front end, and by two stout vertical pins, which, rising up above the block, also serve as centres for the moveable shaping blocks, D, to turn upon, and which are stiffened by means of a tension bar passed across from one to the other above the blocks, D. The block, C, is cast with a raised flange, shaped externally to the internal contour of the bent spoke-bar. The circumferential part of this bar is shaped to fit the inside of the wheel tyre, whilst the sides form the spokes. The circumferential portion of the spoke is bent into shape against the form or mould piece, C, by means of a block, I, which slides between two cheeks or snugs cast upon the block, C, and this block is actuated by a lever, J, connected to it by a link, and working upon a horizontal centre spindle carried by the frame, B. The lower end of the lever is connected by a link-rod to the short arm of a handled lever, K, working on a centre at the front end of the frame, B. The block, I, is pressed forward against the spoke-bar by depressing the lever, K, into the position in which it is represented, from which position it cannot itself return, as the tendency of the strain is to force the short arm of the lever up against the under side of the frame, B. The spoke portions of the bar are bent into shape against the form or mould, C, by means of the triangular swivelling blocks, D, which turn on the pins at their apices, as already mentioned; this movement being effected by the traverse of the frame, B. The bar to be bent is put in in a straight form when the frame is at the front end of its traverse, and when it is in this position, the swivelling blocks, D, are turned outwards, whilst the block, I, is removed back a little from the form, C, to allow the bar to be introduced across in a straight line. When the bar is so introduced, the frame, B, begins to traverse backwards; whereupon the swivelling blocks, D, are caused to turn gradually inwards by the action of two pulleys, E, carried in adjustable bearings in side brackets, F, bolted to the stationary framing. At the same time the block, I, is thrust forward by means of the lever, K, and the frame continues to traverse until the swivelling blocks, D, are turned completely in, to the position in which they are represented in the figure, when the spoke-bar will be firmly compressed on every side against the form, C, thereby receiving the required shape. The bearings, E, of the pulleys are capable of sliding in grooves in the brackets, F, and are adjustable, out or in, by means of screws; and the brackets, F, are strengthened, and made the better able to resist the separating strain, by means of a strong rod, G, tying the two brackets together. When the action of the crank-wheel causes the frame, E, to traverse back again towards the front end of the machine, the swivelling blocks are drawn outwards as they get free from the pulleys, E, by means of counterweights, chains, M, from which pass round pulleys carried by the brackets, F, and are connected to the ends of the blocks in front. At the same time, the block, I, is shifted back by means of the lever, K, and the grip is thus taken off the spoke-bar. Then, as the frame proceeds to the front of the machine, a pair of pendant bell-crank levers come in contact with two pins fixed to the framing, and are thereby made to turn, which causes their other ends to lift up a pair of vertical rods, and these last thrust up the bent spoke-bar above the level of the form, C, so that it can be removed from the machine with facility. The frame, B, also has a pin standing out from one side, so as, on the advance of the frame, to shift a bell-crank lever, L, carried on a pin on the side of the framing. The lever, L, is connected by a link to a second cranked lever, also turning on a pin on the side of the framing, and the other end of this last lever fits in a slot in a rod capable of sliding vertically in bracket-guides bolted to the framing. This rod has a guage-piece bolted upon its upper end, and when the frame, B, comes forward, the rod is lifted by means of the levers just described, so as to raise the guage-piece; so that when a fresh bar is introduced into the machine from the opposite side, its position may be accurately determined by its being entered up to the guage or stop. On the recession of the frame, the guage falls so as to be out of the way of the swivelling blocks, D. The machine is thrown into or out of gear by means of a bell-crank lever, which shifts the clutch upon the driving-shaft; and this lever is connected by a rod, with a lever working on a centre at the base of the framing, and resting above in one of two notches in a plate bolted to the framing. When the lever is placed in the inner notch, the corner of the frame, B, comes in contact with it, and causes the machinery to be thrown out of gear. If the lever is placed in the outer notch, however, the frame will traverse forward without touching it, and the motion of the machinery will consequently continue.

Fig. 2.



In welding wheel-tyres according to this invention, the tyre being bent to the proper shape, and being held in the ordinary diametrical screw-clip, or holding handles, is heated at the point of junction, and is inserted and held between a pair of rollers, shaped respectively to the inner and outer sides of the tyre. These rollers are carried by a frame, capable of oscillation about an axis coincident with the centre of the tyre, and this frame is made to oscillate by a crank or other suitable movement through an arc of a sufficient extent to enable the rollers to act on the heated part of the tyre, the motion being continued until the weld is effected. Or, instead of this plan, the frame carrying the rollers may be made to oscillate on the axis of the inside roller, and the lever by which the oscillation is produced may be fixed either to the spindle of the lower roller or to the frame. When the lever is fixed to the spindle of the roller, the frame in which the rollers are carried may be fixed or stationary, the action of the rollers causing the wheel-tyre to reciprocate, being worked back and forwards through or between them. It is also obvious that the lever may be fixed to the spindle of the upper roller, the rollers in this case also being carried in a fixed framing. One or both of the rollers is carried in adjustable bearings to admit of the introduction or removal of the tyre, and the rollers may be pressed together by screws or springs, or otherwise. By these means the tyres are more effectually and uniformly welded than by the modes at present in use; whilst, by employing the hereinbefore described apparatus for bending the spoke-bars, a great saving in time and labour is effected.

In the modification of wheel-tyre welding machine, represented in fig. 2, the welding rollers are carried in a stationary framing, consisting of two cast-iron side standards, bolted down to a cast-iron base frame, to which they are also connected by a pair of diagonal stays, being connected to each other by a pair of transverse tie-rods. The machine is driven by means of a pair of pulleys upon a transverse horizontal shaft, carried in bearings bolted to the base frame; and this shaft has fast on one of its overhanging ends a pinion, which drives a large spur-wheel, fast on a transverse horizontal shaft, also carried in bearings bolted to the base frame. The arms of the last-mentioned spur-wheel are formed with eyes at different distances from the centre, and in one of these eyes is fixed a pin, upon which is jointed a connecting-rod passing to a crank or lever, fast on the shaft of the upper welding roller. The lever is considerably longer than the radius distance of the crank-pin, and the rotation of the latter makes the former vibrate through a proportionate arc, and this causes the upper welding roller to reciprocate through a corresponding portion of a revolution. The wheel-tyre to be welded is carried in holding handles, and the part to be welded is introduced between the welding rollers, the peripheries of which are shaped respectively to the external and internal contours of the tyre. The machinery being then set in motion, the reciprocating partial rotation of the upper roller causes the tyre to reciprocate, or pass back and forwards between the two rollers, and by these means the required weld is effected, the tyre being of course suitably heated at the part for the purpose. The shafts of the two welding rollers work in bearings, which are capable of sliding in vertical slots in the frame-pieces. The bearings of the upper shaft are adjustable vertically by means of a pair of screw-spindles, working in internal screws in the top of the frame-pieces, and fitted with handles for turning them by. As the welding operation goes on, the lower roller is gradually raised up, so as to nip the tyre more closely; and, for this purpose, the bearings of its shaft rest upon eccentrics, fast upon a lower horizontal shaft, the turning of which last causes the eccentrics to raise up the bearings of the roller-shaft. The eccentric-shaft has fixed upon it a worm-wheel, in gear with which is a worm fast upon an inclined spindle, this last being supported in a bracket-bearing, bolted to the frame-piece, and having a hand-wheel fixed on its upper end, by turning which the requisite lift is given to the lower welding roller. In the modification just described, the lever for working the welding rollers is fixed to the shaft of the upper or outside roller; it will, however, be obvious, that a similar effect will be obtained by communicating the motion primarily to the lower or inside welding roller.

"SISTER HOOKS," OR TACKLE FASTENINGS.

J. M. Murton, *London.—Patent dated May* 21, 1855.

Fig. 1.

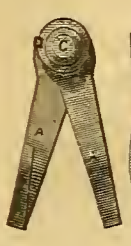


Fig. 2.

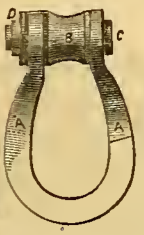


Fig. 3.

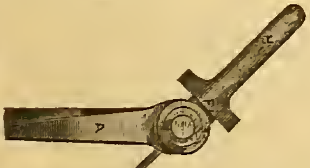
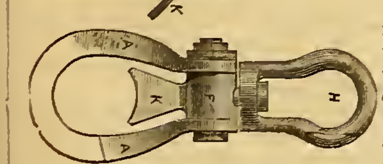


Fig. 4.



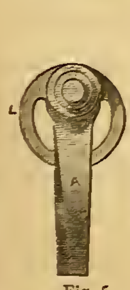


Fig. 5.

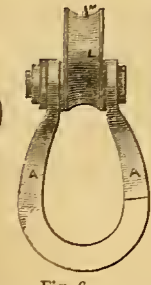
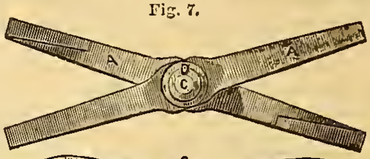


Fig. 6.

Mr. Murton here puts forth a variety of contrivances, for doing away with the insecurity of the ordinary hook fastenings used on board ship, and known as "sister hooks and thimbles," and towing hooks. The chief novelty in the whole of these contrivances, consists in arranging the hooks to open broadwise only, instead of having a universal motion on their joint ends in the thimble, as in ordinary sister hooks. The simplest form of hook is represented in edge and face view in figs. 1 and 2, the hooks being open or separated in the former figure. The hooks, A, are identical in form, and overlap each other when closed. Their joint ends are kept asunder by the roller or thimble, B, round which a rope or block strap may be secured. A strong joint pin, C, is passed through the eyes of the hooks, and through the roller, B, and is riveted upon a circular washer, D, so as to allow the hooks to be opened broadwise, or laterally only. An elastic washer, E, of vulcanized india-rubber, is placed under the metal washer to prevent the hooks from sticking fast, and to render the action easy. It will be obvious that the "mousing" or lashing of the hooks with yarn to keep them closed, will not be needed, as the pull on the thimble will itself keep the hooks closed, whilst, when the strain is taken off, the hooks can be easily opened by hand. Figs. 3 and 4 are edge and face views of a modification of the sister hooks, having a swivel ring, H, connected to the pin, F. As an additional security in places where there is much motion or play, the eye pin, F, may have a projection or tail piece, K, formed upon it; this tail piece being shown in fig. 3, as turned outwards to admit of a thimble being placed upon the hooks, A, after which it is brought into the centre between the two sides of the hooks, and parallel to them, as in fig. 4, in which position it effectually prevents all undue play of the thimble on the hooks. Instead of the tail piece, an eccentric, L, may be used as in figs. 5 and 6. A small pin or point may be fitted on the periphery of the eccentric, for the purpose of preventing the strain of the noose, which is applied round the groove of the eccentric, from displacing or turning the eccentric into the position shown in fig. 6. In figs. 7 and 8 is represented in edge and face view a double sister hook, constructed on the same principle as that shown in figs. 1 and 2. This form of double hook will be found useful in many situations; as, for example, when it is required to connect two ropes with thimbles on their ends, or for connecting the links of a broken chain. In figs. 9 and 10 is represented in face and edge view a form of towing hook, the hook being represented as open in the edge view. The two hooks, N, O, are connected by a joint pin, P, in such a manner as to separate laterally. The ends of the hooks overlap each other at Q, and are so shaped, that when closed, the two combine to form a flush junction of the same transverse section as the jaws of the hooks. The ends of the hooks, from R to S, are made straight, and with the lower portion longer than the upper one, so that the shorter end may be opened clear of the thimble of the towing rope when there is a strain upon it. A bolt, T, is passed through a slot in the arm of the upper hook, and is kept down by a spring, U. This bolt is bevilled off at its lower end, so as to form a sneck, which enters a slot in the arm of the lower hook. By raising the spring attached to the bolt, the latter is released, and the hooks may then be opened. On the lower hook arm is fitted a swivel ring, V, for the attachment of the "painter," the swivel joint being used to counteract the tendency of this last to twist.

Fig. 7.



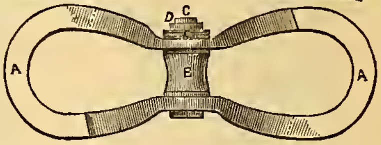
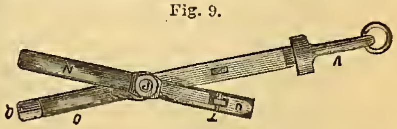


Fig. 8.

Fig. 9.



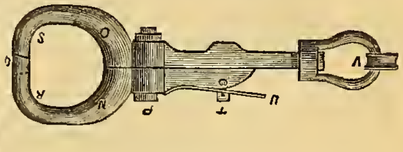


Fig. 10.

Mr. Murton's invention comprehends various other ingenious modifications of retaining hooks of this class, and his contrivances seem well calculated to attain their desired end.

CHIMNEY VALVES.

H. Strong, *Ramsgate.—Patent dated Dec.* 2, 1854.

The majority of the inconveniences due to the defective action of dwelling-house chimneys, spring from the want of a facile means of increasing or diminishing the smoke passage; for one unchangeable proportion of chimney passages can scarcely be expected to act equally well in all states of the weather, and under all circumstances. To supply this want, Mr. Strong has devised an easily adjustable valvular contrivance, which has also the great merit of being applicable, without inconvenience, to chimneys already in use. In our engravings, three modifications of the valves are shown in vertical section. In fig. 1, a pair of valves, A, are represented as applied to the aperture, n, of an ordinary brick chimney. These valves are hinged on a single central spindle, E, which is centred in lugs upon a plate, F, fixed upon the top of the chimney, and upon which plate the valves rest when closed. The valves are opened by means of the levers, C, to which are attached the ends of the chain, D. This chain is passed down the chimney to the fireplace, at any convenient part of which some suitable contrivance is fitted for fixing the chain. The valves, A, have a tendency to close by their own weight, being overhung upon their axis; and they are opened to any extent desired by drawing down the chain, D.

Fig. 1.

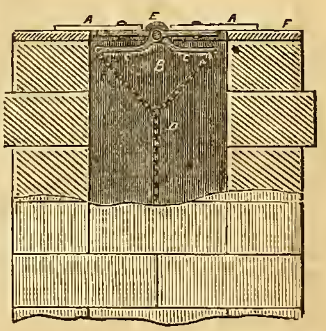


Fig. 2.

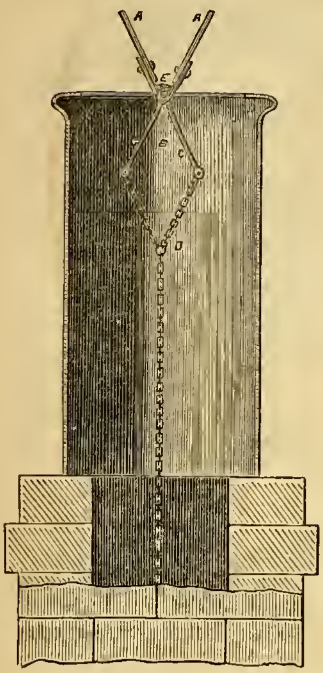
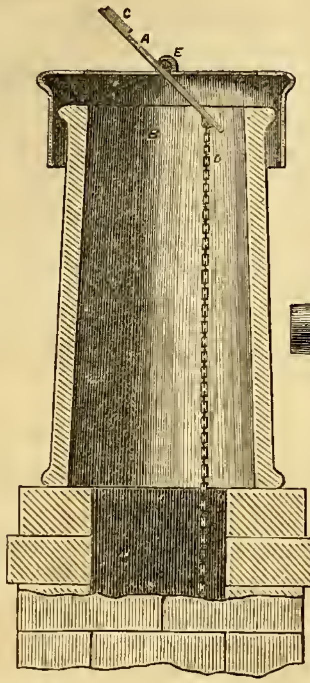


Fig. 3.



In fig. 2, the valves are represented as applied to a metal pot surmounting the actual brickwork of the chimney. In this figure the valves are also shown as nearly full open, the chain, D, being drawn down. The cross spindle, E, which forms the axis of the valves, A, is simply fixed in the top of the metal pot, instead of being attached to a separate plate, as in fig. 1.

In the modification represented in fig. 3, a single valve, A, is used, a weight, C, being applied to one side of it, to give it a tendency to close, whilst the adjusting chain, D, is attached at its opposite side. The valve spindle, E, is carried by a small metal cap, which is shipped upon the earthenware chimney-top, B. This cap may have metal straps fixed to it, and projecting downwards a short distance, and a hand passing round them will serve to bind the cap firmly upon irregular sizes of chimney-tops. When two valve flaps are used, as in figs. 1 and 2, these may be hinged upon separate spindles, or they may be formed with projecting centre points, working in lugs on the top plate or cap. These valves place the chimney current under perfect control, and will be appreciated by those who have experienced the discomforts of down draughts and smoky chimneys.

GAS REGULATORS.

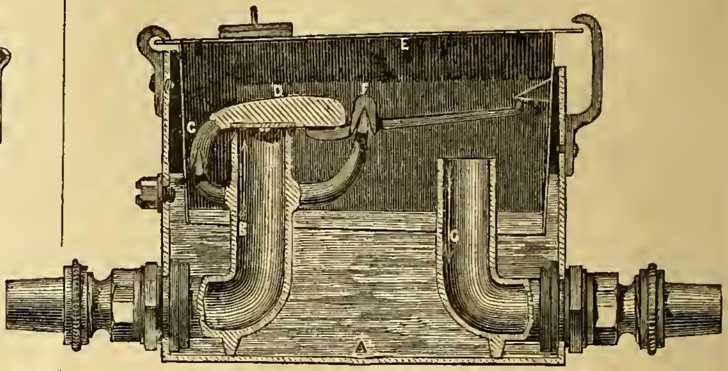
W. Johnson, *London and Glasgow*, (S. W. Brown, *Lowel, U. S.*)
Patent dated April 30, 1855.

The great saving which gas consumers may effect by the use of gas regulators is now generally recognised, and several varieties of regulating apparatus have been brought before the public. It is well known that even the best qualities of gas deposit tar, in greater or less quantities, in the pipes and passages through which the gas passes, and it is this deposited tar which prevents almost all the regulators hitherto in use from operating after a certain period. The tar clogs the valvular mechanism, and causes the details to adhere together, thus preventing their free action, and rendering the apparatus perfectly useless.

The present invention, which is being vigorously worked out by Messrs. J. & J. Lawson of Paisley, comprehends several modifications of gas-regulating mechanism, all designed to avoid derangement from the cause alluded to. Of these varieties, that which seems to be most generally adopted in practice is represented in vertical section in fig. 1.

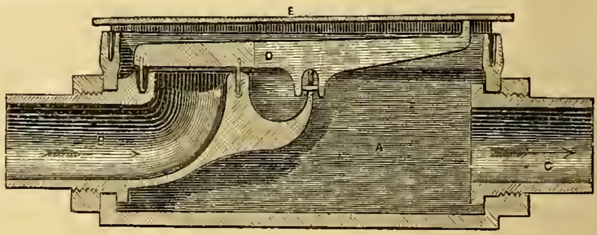
The regulating mechanism is contained in a shallow vessel, A, the gas entering by the pipe, B, and passing on to the burners by the pipe, C. The mouth of the pipe, B, is covered by a valve piece, D, which oscillates on the knife edge, G, on the arm branching out from the side of the pipe. The mouth of the inlet pipe, B, is bevilled off to an edge, so that there may be as little contact surface as possible. The vessel, A, is covered by the float, E, which is weighted according to the pressure at which the gas is to be supplied to the burners. The vessel, A, is filled with water to form a liquid joint for the moveable cover, E, the water being covered with a thin film of oil to retard evaporation. The cover, E, acts on the end of the lever, F, and closes or opens the valve according to the pressure of the gas inside. The valve piece, D, is acted upon by the lever, F, so contrived, that when the valve is shut, or nearly shut, it will act with increased leverage, and have sufficient power on the valve to overcome all tendency to stick.

Fig. 1.



In the modification represented in vertical section in fig. 2, mercury is substituted for water to form the liquid joint for the cover float, E, but of course a much smaller quantity is necessary, a groove being formed round the top rim of the vessel, A, and the float, E, dipping into the mercury in this groove. The valve piece, D, is shaped like an inverted cup, with a rim projecting downwards, and this rim dips into a groove formed round the mouth of the inlet pipe, B; the groove being filled with mercury, so that the gas passage may be completely closed without the rigid metallic surfaces being in contact. The valve piece, D, is set leverwise upon a knife edge, and is acted upon directly by the float, E, without the intervention of a second lever, as in the first modification.

Fig. 2.



Amongst other advantages, these regulators possess that of detecting and indicating any leakage of gas, for when the gas is shut off at the meter, the cover, E, of the regulator will fall if the gas is escaping from any of the pipes in communication with the regulator.

SULPHURIC ACID AND SULPHATES OF IRON AND ALUMINA.

A. Cuninghame, *Glasgow.—Patent dated April* 12, 1855.

This invention relates to the manufacture or production of sulphuric acid, and the sulphates of iron and alumina, from alum schist, alum slate, gentle slate, and what is technically known in some parts of Scotland as "black stone;" that is, a harder species of alum schist, commonly associated, or found lying in connection with, ordinary alum schist, or gentle slate. All or any of these mineral substances, as well as such ironstones and coals as contain sulphur, are applicable and available in this system of manufacturing sulphuric acid.

In proceeding to manufacture sulphuric acid, and the sulphates of iron and alumina, the raw mineral, whether schist, black stone, or other of the mineral substances mentioned is ground, or reduced to powder. To this disintegrated matter, water is added, in quantity sufficient for the production of a plastic mass, capable of being moulded into balls, or bricklike pieces, of such form and dimensions as shall be found conveniently manageable in the after practical manufacturing treatment to which the material is to be subjected. Or, instead of adding water, the mineral substances may be moulded or shaped without any liquid addition. Such balls or masses are moulded either by hand, or, as is preferred, by machinery; such, for example, as is ordinarily used in the manufacture of bricks for building purposes. The balls are then deposited in a furnace, wherein they are subjected to the action of a high temperature, or are calcined.

This calcining process involves the expenditure of but a small quantity of fuel, as, after the balls or masses under treatment are dry, they usually burn of themselves, the bituminous matter and sulphur contained in the schist having been rendered easy of combustion, by the process of disintegration or reduction already described. Under the application of heat in this way, sulphur is driven off from the treated masses under the form of sulphuric and sulphurous acid gases, which are abundantly evolved from them. These vapours are conducted through stoneware or other tubes, or thoroughfares, to the usual leaden chambers, wherein the gaseous matters are to be converted into sulphuric acid in the ordinary manner. If it is intended to make sulphuric acid only in this way, the heating process is carried on until the whole of the contained sulphur is expelled. But if sulphate of iron or alumina is required, the heat is checked, or reduced, at an anterior stage of the action; and the treated bricks, or masses, are afterwards removed and lixiviated, when solutions of these salts are obtained.

The essential feature of the present improvements consists in the grinding or reducing of the alum schist, or other mineral, for the purpose of converting it into masses, as before mentioned. By this process of conversion, such minerals as are comparatively poor in sulphur may be rendered combustible, and applicable for the general purposes which have been indicated.

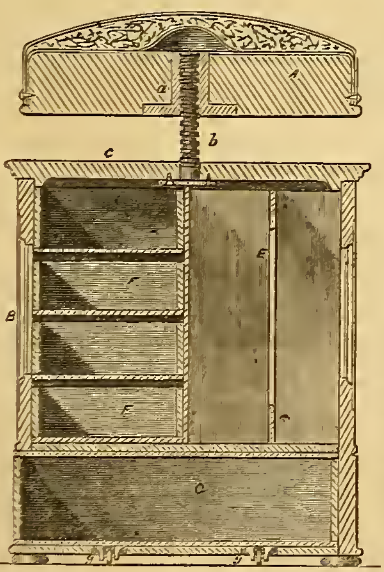
FURNITURE.

J. H. Johnson, *London and Glasgow* (Scholtus, *Paris.*)

Patent dated January 20, 1855.

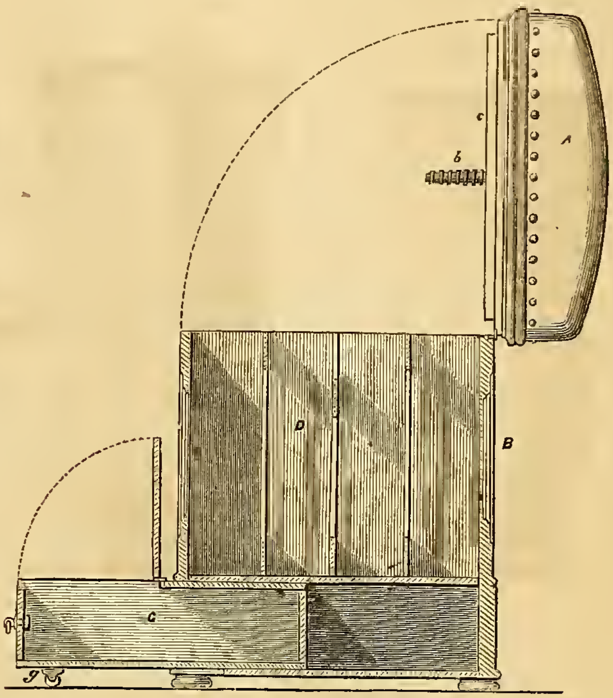
This invention, which we owe to a Paris piano manufacturer, refers more particularly to the construction of music stools in such a manner as to serve as repositories for music books or other articles, but it is also applicable to chairs or seats of different kinds, or destined for various uses. Two modifications of the improved music stools are represented in vertical section in the annexed engravings. In the modification represented in fig. 1, the seat, A, is fixed to the box or body, B, by means of the screw, *b*, which is attached at its lower end to the cover, C, of the box. This screw, *b*, works in a nut, *a*, fixed in the seat, A, the height of which can be adjusted by turning it round upon the screw spindle. Or, instead of this arrangement, the screw spindle, *b*, may be fixed to the seat, A, and the nut be secured to the cover, C, as in fig. 2.

Fig. 1.



The interior of the box or body, B, may be arranged in a precisely similar manner to the articles of furniture at present in use for holding music, so that on opening the cover, any volume or piece of music may be easily selected and taken out. The interior of the box may either be fixed as in the drawings, or it may be made to slide out like a drawer, or it may consist of several drawers sliding out separately. In fig. 1, one portion, E, of the box or ottoman, A, is fitted up as a music case, whilst a set of drawers, F, occupy the other portion. In fig. 2, the entire upper portion of the ottoman is represented as fitted up as a music receptacle. Below this receptacle is a drawer, G, which runs on small castors, *g*, to facilitate its adjustment, and it is fitted with a lid as shown in fig. 2, which, when closed, will answer as a foot rest, or as a seat for children. The form and arrangement of this piece of furniture may obviously be modified in a variety of ways, so as to form a convenient receptacle for any articles, whilst it, at the same time, does duty as a seat or chair.

Fig. 2.

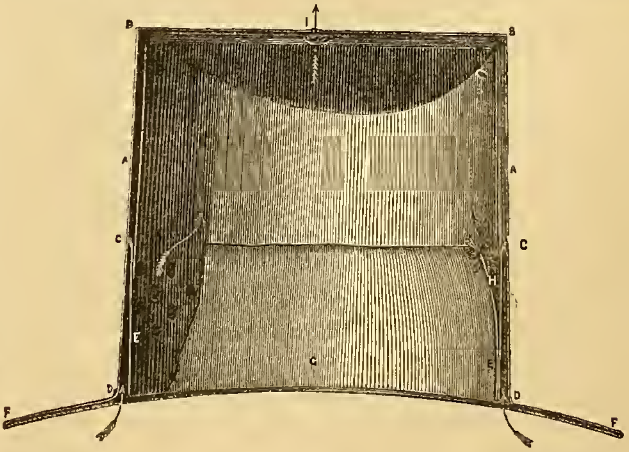


VENTILATOR HATS.

J. Blair, *Glasgow.—Patent dated March* 29, 1855.

The benefit of ventilation in head coverings seems now to be generally recognised, and the various manufacturers are bent on discovering the best means of securing it. Amongst these, Mr. Blair puts forth his claims in the invention which is the subject of the present patent, and he arrives at the desired result by constructing the bodies of hats in such a manner as to form a thin space between the interior surface and the outside of the hat, at the part where the hat fits upon the head, such space communicating by perforations with the interior of the hat above or round the upper part of the head.

Our engraving is a vertical section of a hat as constructed according to the improved system. The cylindrical portion, A, of the hat body is composed of plies or layers of woven material, stiffened by means of shellac or other suitable preparation. These plies are formed into a



single thickness from the crown of the hat, B, to the point, C, rather more than half-way down the side of the hat. The lower part, from C to D, is formed into two thicknesses in any convenient manner, as, for example, by inserting additional plies of material between the inner and outermost plies of the body. The inner thickness, E, thus formed. is slightly contracted in circumference, so as to leave a thin annular space between itself and the outer part—being joined to the body at C. The brim, F, of the hat is attached at D to the bottom of the outer thickness, C D, of the cylindrical portion of the hat body, whilst the usual leather lining, G, is attached by its outer bottom edge to the inner thickness, E. By these means an annular passage or air space is formed between the lining and the outside of the hat; and the inner thickness, E, being perforated at H above the level of the head, whilst the crown of the hat is perforated at I, a free passage is left for the air, so that the interior of the hat is kept constantly well ventilated. It will be obvious to the practical hatter, that the same general form of hat body may be produced in a variety of ways besides that especially described herein, but the essential feature of the invention is the formation of a thin or narrow air space round the portion of the hat body which fits the head of the wearer; this space communicating with the interior of the hat for the purpose of ventilating it.

The invention is obviously applicable to helmets and other head coverings, and in all cases of its application, its use not only induces a good system of ventilation, but also an easy and soft fitting to the head.

We are well able to give an opinion upon this effective contrivance, for we have practically tried it. In about a couple of days, the inner lining takes the exact shape of the head—there being no undue bearing upon any one part—whilst the coolness of the enveloping part is very refreshing after the obduracy of the common hat.

REVIEWS OF NEW BOOKS.

Railways: Their Capital and Dividends, with Statistics of their Working in Great Britain. By E. D. Chattaway, North British Railway. Pp. 133. Woodcuts. London: Weale. 1855.

Mr. Chattaway's inventive faculty has already made itself known in our pages, in the clever "Central buffing and coupling apparatus," forming the subject of one of our plates last month. We have now to deal with him, as well in his literary capacity, as the assistant, and, therefore, working locomotive superintendent on one of our principal lines of railway. Mr. Chattaway brings with him some authority of weight; his little book has therefore some right to be styled a "second volume to Mr. Stephenson's work on railways, in Mr. Weale's rudimentary series." Mr. Chattaway necessarily deals with a large subject within a very limited space; but if he is thus unable to elaborate his expositions to their fullest extent, he has yet contrived to introduce several heads of novelty which previous works of the class have not been able to compass. This is especially the case as regards classified statistical details, which, under Mr. Chattaway's management, bring us within earshot of many interesting departments of the railway system, hitherto secluded from the public eye.

It is somewhat more than a quarter of a century since passenger railways became realities in this country. During that time, very nearly eight thousand miles of railway have been made, involving a capital of more than two hundred and seventy three and a quarter millions sterling, a sum, under existing prospects, fast approaching to three hundred millions. The lines comprehended under this formidable amount, of course, present fortunes of extremely varied character. Thus, whilst the Lancaster and Preston line has shown a dividend of 8½ per cent., there are a great many other lines paying absolutely nothing whatever to their luckless shareholders.

The little work in hand gives us brief but clear notices of some of the latest signal, break, and communicating apparatus, and some good recommendatory notions upon the necessity of adopting a uniform system of railway accounts; but Mr. Chattaway's chief merit arises from his statistical labours, which alone give a sound value to his book. This short section on "railway accidents" will be read with interest, as showing how groundless are the fears of the timid upon the subject of railway travelling.

"During the year 1854, nearly one hundred and eleven and a quarter millions of passengers were conveyed 1,622,048,490 miles, in the aggregate, the number of trains being 1,297,615. During this period there were thirty-one passengers killed, of which number twelve only were killed from causes beyond their own control; nineteen, or three-fifths of the whole, having fallen victims to their own imprudence. It thus appears that, in the year referred to, the fatal cases of accident to passengers, in which any responsibility attached to the railway authorities, were only in the following ratios:—

One passenger killed to every { 9,267,220 passengers conveyed; or
130,170,707 miles travelled; or
108,135 trains run.

"The minor cases of accidents were of course much more numerous; still these did not exceed the following proportions:—

One passenger injured to every { 335,972 persons conveyed; or
4,900,450 miles travelled; or
3,920 trains run.

"We find in these figures that upwards of nine and a quarter millions of persons are conveyed, by 108,135 trains, an average distance of nearly fifteen miles, with a loss of life to one passenger only; and that more than three hundred and thirty-five thousand nine hundred persons are conveyed the same distance, by 3,920 trains, with only one case of personal injury. These figures ought to be sufficient to reassure the most timid, or convince the most sceptical, as to the safety of railway travelling; especially as the number of persons killed and injured, in the year from which these calculations are taken, was considerably higher than the average of previous years. These figures of course refer to accidents which arose from circumstances entirely beyond the control of the passengers. It would be unfair (although it is frequently done) to tax railway companies with the consequence of the individual imprudence of the travellers themselves. It is difficult, therefore, to understand on what grounds an outcry has been raised against railway directors and officers, of indifference to the public safety, and neglect to take even ordinary precautions against accidents. Still more difficult is it to understand why the legislature, which regards with comparative unconcern the fact that two vessels and two human lives are daily lost on the British coast alone from causes which are to a great extent preventable, should be continually harassing directors with threats of bills of pains and penalties for an assumed neglect, of which it must in justice be said they are not guilty."

We may also draw attention to a suggestion which Mr. Chattaway makes as to the formation of a society, consisting of the leading railway officials, for the collection of statistical information, and the discussion of questions bearing upon the economical construction and management of railways. We have seen, within the last few days, that something of the kind has been started in Lancashire, under the name of the "Railway Club." At the inauguration meeting of the Railway Club in Manchester, the chairman, Mr. E. W. Watkin, drew attention to the telling fact, that the modern railway system is conducted by men previously engaged in literary, mechanical, and mercantile pursuits, and from all professions. These men represent a capital of some £300 millions, laid out in giving employment to 90,000 men, and administer an annual revenue of £20 millions. These 90,000 men come to twelve men per mile, a proportion of human hands, which is the result of gradual augmentation, showing that extra care is really taken to avoid accidents. We should be highly gratified to see the Railway Club carried into regular working effect.

Nashville Journal of Medicine and Surgery October, 1855.

This Tennessee serial pursues its way with apparent energy and success. The nature of the mass of its contents precludes us from giving a detailed review; but we may afford wider scope to one of its notes upon the use of "liquid caoutchouc," a valuable preparation, which has recently made its appearance in this country. The writer on this subject says—

"I am compelled to call the attention of the profession to it, as a most useful contribution to our *materia medica*. It is of the colour and consistency of pure milk, but becomes transparent as soon as dry. Owing to its great elasticity, it does not contract so violently as the collodion; it adheres closely to the skin, and allows entire freedom of motion and application to any extent. In burns it has an advantage over anything I have ever used, as also in erysipelas. An acquaintance with it by surgeons will lead, I do not doubt, to many valuable improvements in surgical appliances."

This fluid india-rubber is preserved in the form in which it exudes from the tree, by the addition of a small proportion of free ammonia. It must become a most valuable agent for many purposes.

CORRESPONDENCE.

THE ECONOMY OF STEAM POWER.

Perhaps the whole catalogue of arts and sciences does not present a subject bearing so closely and universally on the interests of mankind as this. It regulates the speed and cost of transit by sea and land in the pursuit of business or pleasure. When expensive, it acts as a most fatal prohibitory duty upon articles of commerce. It attacks all kinds of manufactures at their birth and outset, and is a tariff exacting annual millions from the pockets of all classes of consumers, and consequently of every member of the community. It gives scope for the profitable outlay of capital, and finds employment for labour.

Men of the loftiest intellect have bent their powers to investigate its abstract philosophy, and an illustrious list of engineers, from the time of Watt to the present hour, have brought a colossal amount of practical science to bear on it, and they have been well seconded by a class of which England may well be proud—the artisans. The result is, that a mass of information has been collected which, reduced to practice, enables us already to produce steam so cheaply, that, taking into consideration the certainty of its action and the convenience of its application, it has almost superseded the natural powers of wind and water, and constantly receiving fresh aid from the inspiration of genius, or the no less valuable application of observed facts, it seems likely to continue to outstrip all competing motive powers. Still, such is the insatiable consumption of fuel, that any probable means of materially reducing it is well worthy of consideration. But is a material reduction of the present consumption possible?

In order to answer this question, we must first know, at least approximately, what is the ultimate heat evolved in the process of combustion, how much of it is utilised, and how much allowed to pass off unemployed, as clearly the latter presents the only field for operating economy of consumption. What, then, is the theoretical duty of one pound of coal?—say, for example, Newcastle Hartley, of which we have an analysis, as follows, in Mr. Sewell's comprehensive treatise on steam. Neglecting small portions, it is—

Carbon,	0·82
Oxygen,	0·02
Hydrogen,	0·05
Nitrogen,	0·01
Sulphur,	0·01
Ashes,	0·09
	1·00

Water evaporated from 212° by experimental boiler, particulars of which are unfortunately not given, ... } 8·65 lbs.

He also assigns, as the units of heat in one pound of carbon, 13·268°, and in a pound of hydrogen, 62·470°, which would determine the theoretical evaporative power of the above coal to be

$$\frac{13\cdot268^\circ \times 0\cdot82 + 62\cdot470^\circ \times 0\cdot05}{\text{sum of latent and sensible heat of atmos. steam}} = \frac{14003\cdot26}{1117\cdot7} = 12\cdot53 \text{ lbs.}$$

of water evaporated from 60°; and since one cubic foot of water weighs $62\frac{1}{2}$ lbs., and yields 1,700 cubic feet of steam, 62·5 : 1700 : : 12·53 : 340·82 nearly, and 340·82 × 144 in. × 14·7 lbs. = 721,447 lbs. raised one foot high; and this, according to Mr. Sewell's data, which, I believe, are usually adopted, should represent the ultimate theoretical duty which one pound of such coal is capable of realizing without being used expansively. Impressed with the idea that this result is considerably below the real power inherent in coal, I have sought other means of investigating the subject, and now submit a hypothesis which I believe to be not only new, but a much closer approximation to the truth.

I must premise, that to arrive at perfect exactitude, it would be necessary to know the normal heat evolved in the union of carbon and hydrogen with oxygen, as supplied by the atmosphere. What I mean by normal heat is the temperature which would be imparted to the exact measure of air—chemically necessary for complete combustion—by the union of its oxygen with a given weight of fuel. Supposing it were possible to effect complete combustion with only that measure of air, and that the heat could be isolated from all cooling influences until the consumption was fully effected, it is clear the same thermometric temperature would be measurable whatever the quantity of fuel might be, since each increment of heat would be contained in the portion of air which had served to originate it, and therefore it could not be accumulative.

In practice, complete combustion cannot be effected with the bare measure of air, nor can heat be preserved so as to be measured; but, if consumption *be* complete, the same "normal" heat is evolved, though diluted by the extra quantity of air, and partially dispersed by conduction and radiation. If, then, it could be conducted, radiated, and abstracted from the air to be transferred to water, the theoretic evaporative power hereinafter enounced will be the true one, for chemistry shows that a given weight of carbon yields the same *quantity* of heat, whether consumed on the grate of a furnace, or by the slow process of animal respiration, but its *intensity* depends on the rapidity with which the surrounding media are capable of dispersing the caloric given out. In consequence, we find that in the human body the intensity is regulated with admirable precision to 98°, for the heat is evolved in absolute contact with a most perfect system of conductors, whereas in a blast furnace, where large quantities of heat are rapidly released, the dispersion of which is comparatively slow, an intensity of 3300° is attained. Now, adding to this the heat absorbed by the metal and fresh fuel at the instant of its liberation, that as quickly rendered latent by unconsumed gases simultaneously distilled, and that conducted away by the walls of the furnace, and the absolute intensity of *normal heat* must greatly exceed the intensity noted. However, I am content to assume the observed heat of 3300° as the normal intensity of combustion.

Further, it is laid down in English works, and Du Tremblay's experiments on the Continent bear out the fact, that a given amount of heat generates an equal expansive force, whether applied to produce steam (high or low pressure) from water, spirits of wine, ether, chloroform, or other liquid, or be imparted to air or gases. With this, I now return to the same analysis of coal, and propose to show the amount of gaseous product due to its perfect combustion; then, assuming the temperature to be 3300°, we can determine its expansive force representing the duty of one pound of coal, and since that force is equally due to the amount of heat generated, whether this be applied to gases or water, it follows that the weight of steam representing that force is the weight of water which ought to be evaporated, if we were able to transfer the entirety of the heat to water.

Leaving the sulphur and ashes out of the question, we have, from the same analysis,—

Carbon,	0·82 lb.
Oxygen required to consume same = 0·82 lb. × $2\frac{2}{3}$,	2·19
Carbonic acid gas resulting,	3·01
Which, at 9 cubic feet to the lb., gives cubic feet,	9
	27·09
Hydrogen 0·05 at 170, do. do.	8·50
Oxygen to consume same = 0·05 lb. × 8 × 11 c. ft. per lb.,	4·40
Oxygen contained in the coal, 0·02 lb. × 11 c. ft. per lb.,	0·22
Nitrogen do. do. 0·01 lb. × $13\frac{1}{2}$ c. ft. per lb.,	0·13
Nitrogen in air which supplies the oxygen, as above, viz., 44 times the weight = 2·19 lb. × 0 40 = 2·59 lb. × 11 × 4,	113·95
Total gaseous product,	154·29
Say 154·30 cubic feet at 3300°.	

Since gases increase their volume $\frac{1}{480}$ for each additional degree of heat imparted or being confined, their pressure augments in the like proportion—the pressure due to 3300°. $\frac{3300^\circ}{480} = 6\cdot875$ atmospheres = 6,875 × 14·7 lbs. = 101·06 lbs. per square inch—say 100 lbs. per square inch.

Then, neglecting expansion, as before, the duty of 1 lb. of coal is represented by

154·30 × 144 × 100 = 2,221,920 lbs. raised 1 foot high,
instead of 721,447 do. do.

That is more than three times the duty assigned by the previous formula, and equivalent to 38·6 lbs. of water evaporated from 60°.

Or, taking another view: 154·3 cubic feet of air heated to 3300°, and free to expand as in a furnace, would increase its volume, as shown above, to 154·30 c. ft. × 6,875 = 1060·8 c. ft., so that the heat it represents may be taken as

$$1060\cdot8 \times 3300 = 3\cdot500\cdot640^\circ \text{ and } \frac{3\cdot500\cdot640 \times \cdot2669}{1117\cdot7 \times \cdot847} = 987; \text{ that is,}$$

$$\frac{\text{the heat in the air} \times \text{specific heat of air}}{\text{heat of atmospheric steam} \times \text{specific feet of steam}},$$ gives 987 cubic feet of steam at atmospheric pressure, representing a force of 2,089,281 raised 1 foot high (for 987 × 144 × 14·7 = 2,089,281), a result nearly identical with the foregoing.

The whole reasoning hinges upon the assumption that 3300° is not too high to assume as the initial intensity, and since the quantity of heat arising from a given weight of carbon is admitted to be invariable, the real intensity must also be fixed, the measurable intensity being the original heat more or less diluted, as it were, so that the highest measured heat can never be in excess of the normal intensity.

The quantity of fuel consumed in a given time can in no way affect the case, for a given number of human beings consume as much carbon in the same time as an iron furnace, and evolve as much heat, absolutely vaporizing as much water as the furnace heat could do if so applied; but the comparative absence of cooling influences in the furnace admits of a nearer approximation to the normal intensity.

I have not, however, availed myself of the highest recorded heat, for Mr. Sewell states that 3479° has been observed in an iron furnace; neither have I made a distinction between the calorific values of carbon and hydrogen, though the latter is considered to be nearly five times greater, so that the duty of one pound of coal may possibly greatly exceed that I have assigned it.

My views derive some support from what is known of Cornish engines. When these, under very favourable circumstances, perform a duty of 100,000,000 lbs. raised one foot high, by the consumption of one bushel (84 lbs.) of coal, the evaporation, even with their enormous expansion, must necessarily equal 12 lbs. of water per lb. of coal. Yet experiments made at such times show, that although the air leaves the flues only a very few degrees hotter than the steam contained in the boiler, still 2000 cubic feet of air, at least 160° above the temperature of the atmosphere, is carried off per minute, and that this hot air contains a large quantity of olefiant and carburetted hydrogen gases unconsumed, and a still larger quantity of carbonic oxide, of course, only half consumed; and these gases represent, not only a great amount of undeveloped heat, but also a further quantity rendered latent during their evolution.

However, I shall be shortly able to prove the correctness or error of this theory, as I am fitting up a boiler that I have designed to occupy but little space, yet utilise the whole of the heat generated in a furnace contained within it. This furnace is eminently adapted to effect the perfect combustion of the volatile elements of fuel. The apparatus will be self-feeding and self-regulating, so that, while the engine is at work, it will be a physical impossibility to consume more fuel than is due to the work performed, while the pressure of steam will be sensitively regulated to the exact point at which it may be adjusted, so that a safety-valve will be no further necessary than may be required to blow off steam while the engine is at rest. Hence, the pressure in the boiler being constant, its size small, and form of the strongest, all danger from bursting is obviated, even when that pressure is as high as 60 lbs. per inch, at which I purpose working my experimental engine, cutting off the steam at one-third the stroke. By this means, and heating the feed-water to a minimum of 212° with the waste steam, I should be able, by calculation based on the foregoing hypothesis, to realize, without condensation, and with the fullest allowance for friction, a duty of one horse power by the consumption of one lb. of coal per hour.

I am causing a pump to be attached to the engine expressly to measure the weight of water it is capable of raising a given height, and I shall have the additional tests of the friction dynamometer and indicator diagrams.

In a few weeks the experiment will be made, and whether success or failure result, I shall be happy to furnish all particulars, as well as drawings of the apparatus employed.

F. H. Edwards.

FEEDING STEAM BOILERS.

The system of feeding steam boilers, which you have noticed approvingly in connection with my steam cultivator, would act, in my opinion, as a sure preventive of explosions, as I think there never was a case of explosion from any other cause than that of the water getting below the line of the heating surface. Excessive pressure resulting from any other cause would merely rend or burst the weakest part of the boiler, and this would merely be attended with danger from scalding. I further believe that it is not through ignorance or inattention on the part of the engineman that these accidents occur, but solely on account of the absence of means of getting the feed-water into the boiler when he sees that it is diminishing.

The pump is an excellent contrivance for feeding, and it seldom fails to do its duty; but it is in this very non-liability to fail that the danger really lies. It does occasionally fail, and boilers are often much injured on that account, although, perhaps, not one boiler in a hundred explodes under such circumstances. There are two or three reasons for the failure of the pump. The principal one is the continual hammering of the suction or inlet valve upon its seat, catching sand or other impurity in the water, so that the working surfaces become open, although the injury is often hardly perceptible to the naked eye. At first the water escapes back to the reservoir merely in minute quantities; but after a time the evil increases, and hardly any water gets through the boiler clack.

I am of course aware that grinding the valve upon its seat is often resorted to as a remedy, this being frequently done by the engine attendant; and although the pump, when really in good order, can usually give three or four times the quantity of water necessary for the boiler's consumption, yet the defect to which I have alluded will sometimes get so bad, that it cannot possibly maintain the working level, even when kept continually at work. The engineman is perhaps aware that he is losing water, and tries his best to discover the cause, becoming nervous and fidgety, knowing that he is there for the purpose of preventing the evil; and he says nothing about it, hoping on until the mischief takes place.

All that I have described has occurred in the establishment where I now am, and to prevent fatalities I have had to rake out the fires eight or ten times within four or five years. I positively believe this to be the cause of all steam-boiler explosions, and I consider that the system which you have so well described, when properly arranged, would be a certain cure for the evil. Instead of stopcocks, I should prefer to use valves actuated by screws. There should be two steam-pipes, one to take the steam to near the bottom of the water, in what I call the feeder, to heat the water before admitting it into the boiler; the other for the purpose which you have described. The pipe to take the water into the boiler should be a wide one, nearly twice the diameter of what would be fitted up for a pump, as all the force in it is merely that due to the head level of the water. This pipe should be so arranged that, by taking off a cap on the outside of the boiler, a man could put a drill, made for the purpose, through that part of the pipe which dips into the water in the boiler every time the boiler is cleaned; this part rapidly becoming like the inside of a tea-kettle. There should be two of these feeders to each boiler, to be filled and emptied alternately. They should also be so arranged that they may be filled by opening a cock from a cistern at a higher level, a lift-pump being added as a further safeguard; whilst, should these fail, hand-filling may be resorted to.

I fear, however, that my proposition will be met with ridicule, as the pump does seem to be the very thing for the purpose; and yet I do not see why the feed-water should be knocked into the boiler as it were by a hammer, if it can be made to go quietly in, in virtue of its own gravity.

J. D. Phillips.

Cour de Prince, à Gand Belgique, Nov., 1855.

PARISIAN SMOKELESS FURNACE.

During a recent residence of a few months in Paris, I fell in with a very admirable smoke-prevention apparatus, more perfect, I think, than any that have yet appeared in this country. The invention is quite new, and has only lately been carried into practice. It is called *chauffage par le gaz*, or heating by gas, because the fuel is turned into gas previous to being made use of. The apparatus which I saw was working at the Pompe à Feu, or Water Works, at Chaillot, Paris; the engine was 80 horse power. The apparatus consists of a generator, and a fan blast for forcing a current of air through this generator. The latter is merely a square iron box, with an outside casing surrounding it, filled with water. The fuel is introduced by a door at the top, and the draught of air from the fan through a grating at the bottom. The coal becomes by this treatment almost entirely converted into carbonic oxide, which is conducted out by a pipe near the top of the generator, and taken to the boilers to be consumed. The water surrounding the generator is placed there for the purpose of preventing the heat from rising too high. If this were not the case, the fuel would be entirely consumed instead of being merely converted into a combustible gas. At the point under the boilers, where the gas is burned, a proper proportion of air is admitted to aid the combustion. This arrangement does away with all necessity for a chimney. There was merely a small one, some fifteen feet high, as an outlet for the waste air; out of this no smoke whatever was issuing; in fact, the whole affair, boilers and everything, was under a roof. I am told that the saving by this apparatus, over the ordinary furnaces for boilers, is 50 per cent., and that, from some experiments that have been made, 10 lbs. of water are converted into steam by 1 lb. of coal. The inventor of this ingenious apparatus calls himself Monsieur Beaufumé; he has taken out a patent for it for Great Britain, and we shall doubtless be hearing of it in this country before long. It fulfils the object sought to be attained by lofty and expensive chimneys, that of causing a good draught, with this additional advantage, which chimneys do not possess, that of the prevention of smoke and perfect economy of fuel.

November, 1855. Smoke Prevention.

THE FARMER'S MECHANICAL AIDS.

I have read, in the last Part of the *Practical Mechanic's Journal*, your comments upon some remarks of mine, addressed to the Kirkby Lonsdale Agricultural Society, at a meeting where, as you state, I was the "impromptu" chairman. To any amount of fair criticism, I am the last man to object; but I trace, in what you say, a bitterness of tone which I hardly deserve. I shall endeavour to show you that, in the main, we positively agree in our views. The whole tenor of the advice which I took the liberty of offering to the farmers was, "Plough deep—clean your land well—manure as heavily as you can; and, above all, drain as much as possible, getting your landlords to aid you as far as possible." But I further recommended them not to indulge in every new scheme which comes out; not to ruin themselves, as you yourself word it, by "lavish expenditure upon showy but imperfect apparatus;" but to wait and see how new implements answered in the hands of those gentlemen who, as pioneers of improvement, bore the brunt of practically ascertaining the difference between the useful and the trumpery.

Whether "discriminating" or not, my speaking of gentlemen in contradistinction to tenant-farmers could intend no slight. I obviously wished to distinguish between landlords who could afford to try such novelties, and farmers who could not. Whether or not I aspire "to fill positions above my fellows," I shall never counsel them to do what I think both unwise and foolish.

A few words as to myself. I have farmed, for this district, largely, and for many years my farm work has all been carried on by steam power, and that at a time when even Mr. Mechi was ridiculing steam engines as applied for farming purposes.

I have used the reaping machine, as made by Crosskill, for three years; and this implement, as improved by my own people, received the warm approbation of the committee and judges of the Royal North Lancashire Agricultural Society at their last meeting; and not only gained the medal and the highest prize, but gave great satisfaction to some hundreds of spectators. I also use the excellent gorse-cutting machine, by Messrs. Barrett & Co. of Reading. On the good qualities of this machine, I have every season to write many explanatory letters. But in dealing with all the machinery which I have ever purchased, it has always been my system to ascertain previously whether or not it was likely to answer in practice. Such was the advice which I presumed to give at Kirkby Lonsdale, and this counsel I mean to pursue.

W. A. F. Saunders.

Wennington Hall, Lancashire, Nov., 1855.

NASMYTH'S STEAM HAMMER, WITH WILSON'S CYLINDRICAL VALVE.

The engraving of this hammer, given in the *Practical Mechanic's Journal* of last month, gives an accurate representation of the tool as fitted up for several parties; but, in the original design, as well as in that to which I now work, the steam-pipe is different. The steam-pipe, as engraved, terminates in the upper side of the valve box, and the consequence is, that the water of condensation is apt to lodge in the valve box when the hammer is at rest, and a small discharge-pipe must be put in to carry off this deposit. This pipe demands some attention from the workmen, and it is better to dispense with it. If, therefore, the steam-pipe is brought in by a curve from below, no lodgment will occur, and I now fit all the hammers in this way.

I am wishful, also, to prevent its being in any way supposed that I claim credit for the use of the hand-gear, or the working the hammer by hand instead of by a self-acting motion. Mr. Nasmyth's original published drawings clearly show the hammer worked by hand; and I believe that the manual system would have been continued had not the earlier hammers proved to require labour too severe for any man to accomplish. This will be obvious when we remember that the only valve applicable at that time was the short slide, which was found to be excessively hard to move, even after the adoption of several contrivances for relieving the steam pressure. It was thus that recourse was had to the self-acting gear; and now, with my hand gear, I am only coming back to the original plan, the credit of which undoubtedly is due to Mr. Nasmyth.

Low Moor, Nov., 1855. R. Wilson.

RAILWAY CARRIAGE BUFFER-HEADS.

The rubbing action to which the buffer-heads of railway carriages are subjected is so serious, as to cause the wood discs to work loose and fall off, however hard they may be screwed up. The remedies which I have ordinarily seen practised have only been partially effectual. I therefore suggest the formation of a bevilled flange upon the iron head, to receive the wood disc, so that the latter cannot work loose. For greater security, short bolts ought to be used instead of screws, as the compression to which the wood is subjected loosens the screws. If well fitted, my iron flange will also protect the edges of the wood disc from being chipped off.

November, 1855. Kenneth.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Glasgow, September, 1855.

Section G.—Mechanical Science.

"On the Quarrying and Blasting of Rocks," by Mr. William Sim, of the Granite Quarries, near Inverary.

The ordinary method of blasting rocks involves three distinct operations—namely, the boring of the holes, charging them with gunpowder, and firing them. These processes are in general tedious, uncertain, and unsafe. It was, therefore, natural to expect that, in an age of progressive science, some endeavour should be made to improve on them. The first attempt of this kind was made several years ago at the chalk cliffs near Dover, on the works of the South-Eastern Railway Company, when a blasting operation on a scale of surpassing magnitude was effected by an explosion of 18,000 pounds (or about 8¼ tons) of gunpowder, fired simultaneously in three mines by electrical communication, and with complete success. No further effort in this direction was made until the contractors for the Government breakwater at Holyhead commenced their works there. It being found by them that the ordinary mode of blasting could do little towards supplying the enormous quantity of from four to five thousand tons of stone per day required for the breakwater, they had recourse to the system of blasting on the Dover Cliff principle, and with the most successful results. On that principle the contractors for these works are at the present period expending no less than 300 tons of gunpowder per annum. Its first introduction into Scotland occurred in my own practice at the granite quarries, on the estate of his Grace the Duke of Argyll, at a small village called Furnace, situated on the banks of Lochfyne, about eight miles south-west from Inverary. These quarries are wrought chiefly to supply the city of Glasgow with causeway paving-stones. The material is of a very hard description, as will be seen by the specimen submitted. In proof of its hardness, it may be remarked that a tool which will bore from 12 to 15 inches in ordinary granite without requiring to be sharpened, will in this only bore 2½ inches.

The great expense incurred in boring, blasting, and quarrying a hard rock of this description—required in large quantities—the tediousness of the process, and the shattered state and angular form in which the rock was displaced by the ordinary method of blasting, induced me to adopt the Dover Cliff system. Accordingly, a blast on a large scale was prepared and fired in the month of September, 1852, with such results as to induce me to continue the system ever since. Up to the present period I have fired ten blasts on that principle, varying in position, and with charges of gunpowder of from 1500 to 6000 lbs. As my experience has enabled me to divest the process of much of the intricacy attendant upon the blast at Dover Cliffs, and considerably to simplify the operation, I may be permitted to present a brief outline of the results, in the hope that it may tend to the general progress of this department of mechanical science. I purpose to consider the subject under the five following heads:—

1st. As to the best position in a quarry for a large blast.

2d. The mode of placing and forming the mines.

3d. The formula adopted for calculating the quantity of gunpowder required.

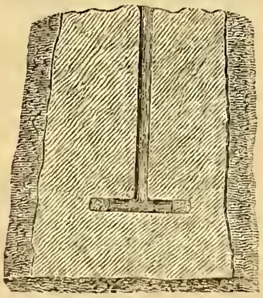
4th. The placing of the gunpowder, electric wires, and safety fuse, and the stemming of the mines.

5th. General results, with estimate of cost, and the applicability of the system to various descriptions of rocks.

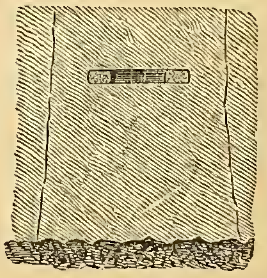
1st. As to the best position for a large blast, it is desirable to select such portion of a quarry as possesses the quality of being the most uniform in its formation, throughout the length, height, and thickness of the mass to be displaced. The success of these blasts are very much dependent on their relation in point of proximity to the natural dividing joints which are found in the rock, particularly to those which run in a clean seam from top to bottom of the quarry face. Joints of that description are technically named main or leading backs. Before proceeding to fix the site for a blast, it is of the utmost importance that these, so far as external examination will permit, should be carefully traced, and their relative bearings to the quarry face distinctly understood. As a general rule in this system of blasting, 40 feet ought to be adopted as the minimum height of the mass to be displaced, and about 80 feet as the maximum. The intended position of the powder-box may be considered as the line of thickness of the mass to be displaced, and it is to be regulated by the line of height. As, for instance, if the mass to be operated upon be 60 feet in height, the situation of the powder-box should be 40 feet in from the quarry face, being one-third less in line of thickness than that of height. Where the rock exceeds the maximum height of 80 feet, it should be apportioned and brought down by a series of lifts, each having a height of 60 to 70 feet above the level of the powder-box. By these means it is quite practicable to bring down any mountain, whatever may be its height. From what has just been stated, it will appear that the qualities requisite to a favourable position for placing the mines are—solid rock with good natural dividing joints, and moderate height of rock above the level of the powder-box.

2d. Having secured a favourable position, the next step is to fix the direction of the mines. These may consist of vertical shafts sunk from the top of the quarry to any required depth, with horizontal mines or headings branching off at the bottom of the shaft; or vertical shafts may be altogether dispensed with, and headings only be employed, driven in a straight line from the quarry face to the required length, and then turned off at an angle to the right or left, or both if requisite The elevation and plans herewith given show the position of the mines employed in the first great blast at Furnace, in September, 1852. These, it will be observed on the section, consisted of a vertical shaft sunk 60 feet deep, and within 20 feet of the level of the quarry floor. Two headings branched off, right and left, from the bottom of the shaft, each being 15 feet in length, or, in all, 30 lineal feet of headings, and 60 feet of vertical shaft. These took the form of the letter T turned upside down. At the extreme end of each heading, boxes for containing the gunpowder were placed, their position being at 50 feet thickness in from the quarry face, and 10 feet from the natural dividing joints. This affords an idea of mines in which the vertical and horizontal are combined:—

Elevation of large blast, tried Sept., 1852.



Ground Plan.



There is also submitted another sketch of headings in the "zigzag" form. These are more troublesome to prepare, but have the advantage of being more secure. I have already noticed the importance of a correct knowledge of the positions of the natural dividing joints. It greatly facilitates the formation to commence the mouth of the mine at the level of the quarry floor, entering inwards by the side of one of these leading joints to the length required, and then turn off at a right angle in a direction towards the next dividing joint; but it is unnecessary to approach nearer to it than the distance requisite to equalise the lines of resistance. The powder will force its way to the natural dividing joint, but not through it, however near it may be placed. The size of the mine need only be sufficiently large for a man to work in it. They are generally about 3 feet 6 inches square. As the mines thus only allow one miner at a time to be employed, when the work will not admit of delay, the mines are progressed night and day by the employment of three miners, each of whom works an eight-hours' shift. The miners are paid at the rate of twenty shillings per lineal foot, they finding their own light, gunpowder, and fuse—in short, everything except implements, which are provided and maintained for them. The greatest amount of work which each miner performs weekly is three lineal feet, but the average will be about two feet. The wear and tear of jumpers is excessive. In the formation of ninety lineal feet of mine, they required to be sharpened no less than three thousand and sixty-eight times.

3d. The mines being formed, the next step is to determine the quantity of gunpowder required. The formula adopted at the Cliffs of Dover, and also for some time at Holyhead, was to have charges in lbs. of gunpowder equal to 1-30th of the cube of the line of least resistance; but it is now found better to cube the mass of rock intended to be displaced, and ascertain the probable number of tons, then allow, as the maximum charge, one lb. of gunpowder to every three tons of rock.

The details of my calculation for Blast No. 8, being the one with the zigzag mines, of which the plan is submitted, are as follow:—The mass to be displaced was 33 feet in length to the square of the mines, by 50 feet in thickness in from the face, and 70 feet in height. It was supposed that the gunpowder would force its way lengthways other 17 feet. The mass was therefore computed at 50 × 50 × 70, equal to 6500 cubic yards; but 500 yards were deducted for inequality of surface on the top of the rock, thus there remained to be displaced 6000 cubic yards, equal to 12,000 tons. To displace this with the ordinary proportion of 1 lb. of gunpowder to every three tons of rock, would have required 40 barrels, or 4000 lbs., but on account of the regular form or lie of the rock, it was resolved to reduce the ordinary proportion of gunpowder to half the usual quantity, and only 20 barrels, or 2000 lbs. were used. With this reduced charge the blast was perfeetly successful. It will be observed that the quantity of gunpowder was about 5 ounces per cubic yard, or 2½ ounces per ton of rock displaced. This may be considered a minimum charge. Each blast is of course attended by favourable or unfavourable circumstances, scarcely any two being alike, but as a general rule the maximum and minimum charges of gunpowder just mentioned may be safely adopted.

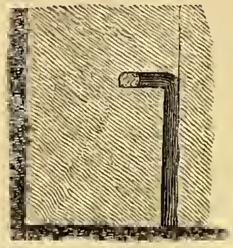
4th. Having determined the quantity of gunpowder to be used, the next part of the process is to form and place the powder boxes in the mines; the size of box required is easily ascertained, by assuming the weight of the gunpowder at 62 lbs. per cubic foot. The boxes may consist merely of a few pieces of coarse deals of timber and a small quantity of felt, similar to that which is used for the roofs of houses. These materials are carried into the mine, and put together in their place. To prevent any damp reaching the gunpowder, the bottom of the box is raised a few inches above the level of the floor of the mine, and a sheet of felt passed under the bottom and up each side of the box, then another sheet is placed so as to line the arched roof of the mine above the powder box. This roof sheet is easily kept in its place by means of segments of wooden hoops.

5th. The next and most important process of the whole is that of placing the gunpowder in the box; workmen are so notoriously careless in guarding against accidents in any operation of this kind, that it should on no account be left to them, except under the charge of some skilful and attentive person. On one occasion I detected a miner proceeding to stow gunpowder by the light of a common stable lantern full of apertures. On another I found one packing in the last remains of three tons of gunpowder into the box with a common iron tinned scoop, and occasionally striking the scoop against the hard granite rock. The man, in his ignorance of the fact that in such circumstances tinned iron might strike fire, was busy paving the way for a fearful premature explosion. The precautions necessary to be used are first to sweep out the mines, then cover the floor and also a small space round the outside of the entrance with a matting of empty sacks. The barrels of gunpowder, 100 lbs. in each, are then deposited on the matting, and the head of each cask staved in with a wooden mallet. These barrels are then emptied into smaller ones, each containing about 25 lbs., and are conveyed to the powder box by men seated in a row at regular intervals in the mine, who pass it from one to another till it reaches its destination. The men thus employed should be cautioned against having combustibles, such as lucifer matches, in their pockets, and directed to work with their shoes off. In charging mines with a vertical shaft, the barrels of gunpowder are emptied into small bags, which are lowered down and received at the bottom of the shaft.

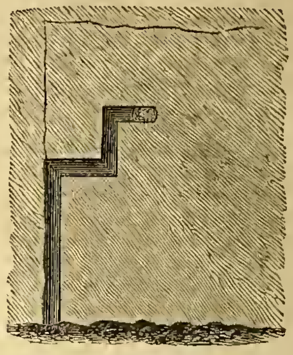
I submit another, showing the position of a mine wherein vertical shafts are dispensed with, and only headings employed. This description of mine is entered at the end of a portion of the rock upon a level with the quarry floor. It was driven straight in from the end of the rock, in a line parallel to the face of the quarry, to the distance of 40 feet, then turned off at a right angle towards the quarry face other 12 feet, at the end of which the powder box was so situated as to be respectively 40 feet in length from the end at which the mine was entered, and 40 feet in thickness of rock from the quarry face, with a burden 60 feet in height. This is a most convenient form of mine, but has the disadvantage of not being so well fitted to resist, as many other forms, any overcharge of gunpowder.

6th. Having thus placed the gunpowder in the boxes, the next operation is to insert the ends of the fuse and the cartridge of the electrical wires into the centre of the mass of gunpowder. Immediately afterwards a thick wall of firm green turf is built up so as to cut off all communication between the mine and the powder box. This being effected, the most dangerous part of the operations may be considered as completed. The building up or stemming of the mine is then proceeded with. At Holyhead they have entirely dispensed with the use of masonry, Roman cement, or mortar, for that purpose, merely using the fine quarry debris mixed with clay, and well rammed home. In my own practice I still adhere, to a certain extent, to the use of rubble masonry and Roman cement, particularly for the first ten feet next to the powder box, and after that rubble building and sand. As the building proceeds, the safety fuse and the wires are protected in a casing of grooved slabs of timber; these may be of any length required, and are built in securely along with the masonry or stemming. When electricity is to be employed as the igniting agent to fire the charge of gunpowder, it is considered necessary to place one or more lines of safety fuses into the case, along with the electrical wires, to act as a reserve in case of accident to the battery or its wires.

Ground Plan.



Ground Plan of Zigzag Mines.



The employment of electricity is only requisite when more than one box of gunpowder is to be fired; and, as the effect of the blast is dependent in so great a degree on its relation to the natural dividing joints, and as these are in general not very remote from each other, it is found that one box of gunpowder is more economical and proportionally more effective than when more than one is used. When only one box is to be fired, the process is much simplified by dispensing with the use of electrical communication. The gutta percha safety fuse itself is quite sufficient, being at once safe, economical, and effective. It is very compact and flexible, has great powers of resisting damp, and has proved itself a most invaluable agent to all who are engaged in quarrying or mining operations. Previous to its introduction many lives were annually lost by the imperfect mode of firing them adopted, these being either by means of a train of gunpowder communicating with the charge in the blast, or by straws filled with gunpowder. A proof of its utility may be shown by immersing a small piece of it in a basin of water, leaving the two ends exposed, and, on igniting the one end, it will burn right through the water to the other. It burns very steadily about two feet per minute, so that, from the time the fuse for a large blast is ignited, about thirty minutes elapse ere the explosion takes place. The effect produced by the explosion of a well-balanced blast may be described as follows:—There is no sharp loud report similar to what takes place in the ordinary mode of blasting; there is merely a low rumbling noise like that of distant thunder. The stones are not propelled to any great distance. The displaced rock does not fall much further than that of three times the height of the quarry-face; and there is no concussion of the air. In the first great blast at Furnace, in September, 1852, in which 6,720 lbs. of gunpowder were exploded and 32,000 tons of rock displaced, the dwelling-houses were so situated as to be almost in the quarries, yet not a pane of glass was broken. Some subsequent ones have not been so successful, as by them part of the dwelling-houses have been hurled into the sea; but these occurrences did not arise from any defect in this system of blasting, but should rather be attributed to their being of an experimental character in situations adopted from necessity, no room being left for choice. This paper may be concluded with a few remarks on the question of cost, and the applicability of the system to various descriptions of rocks.

1st. As formerly remarked, the cost of driving the mines is 20s. per lineal foot; to this there falls to be added wear and tear of tools, 2s. 6d., placing the gunpowder and stemming about 1s. 6d., or, in all, 24s. per lineal foot of mine. The present price of gunpowder is 64s. per barrel of 100 lbs. The average cost of the mass of rock displaced, so far as consists with my own practice, is at the rate of 8d. per cubic yard, or 4d. per ton. This system of blasting is not applicable to any of those rocks in which the principal material required exists in narrow veins, because in such cases the great burden of useless debris which would be brought down would incur a greater cost for its removal than could be saved by the improved mode of blasting. It is, however, well adapted to all descriptions of rock which are used in great quantity, and require to be displaced in masses, such, for instance, as the quarries at Holyhead breakwater, and at Furnace and Bonaw granite quarries, where to effect the manufacture of 5,000 tons per annum of paving-stones, no less than from 50,000 to 100,000 tons of rock require to be displaced. It may also be applied in extensive quarries of basalt, limestone, marble, and freestone. Neither is there any risk of these rocks being shattered and broken into pieces by the violence of the explosion. Experience has plainly indicated that, by this system of blasting, the parties employing it have in their hands an agent, and the means of applying it in such manner as perfectly to regulate its power to a greater or less degree, as may best suit the circumstances of the case.

Gunpowder has and is still advancing in price to an extent which now renders it a most expensive explosive agent; but, as the system of blasting just now described will admit of the employment of other explosive compounds, irrespective of their bulk, a new field of inquiry is opened up to the scientific world, to discover some explosive power which may be employed to do the work at a cheaper rate than that of gunpowder.

SOCIETY OF ARTS.

November 21, 1855.

This was the first ordinary meeting of the 102nd session. The Rev. J. Booth, F.R.S., chairman of Council, presided, and read an inaugural address in conformity with the usual custom. In the course of his remarks, he stated that Mr. Chadwick, having drawn the attention of the Emperor of the French to the advantages to be secured in Paris by the adoption of a thorough system of drainage, one of the worst drained districts in that city had been placed under Mr. Chadwick's control.

MONTHLY NOTES.

The End of the Great Exhibition at Paris.—The finish of that great undertaking which has given a spur to the industrial workers of all countries—and still furnishes our pages with so much food for comment—has at length come to pass. The 15th of November saw the last of the spectacle, and produced the official declaration of the names of winners of prizes or "honourable mention." After the formal address to the Emperor, who, with his Empress and the court, attended in all the pomp of continental grandeur, and the reply of the Emperor, who spoke out boldly on the war, the prize-holders of all classes were presented in due form, and the medals and crosses were handed to each by the Emperor himself. The following is the imperial decree as to the honorary distinctions bestowed on the members of the international jury:—

Napoleon, by the grace of God and the National will, Emperor of the French, to all to whom these presents may come greeting. On the report of our well-beloved cousin Prince Napoleon, President of the Imperial Commission of the Universal Exhibition of Agriculture, Industry, and the Beaux Arts, and on the proposition of our Minister of Foreign Affairs, and of our Minister of Agriculture, Commerce, and Public Works, in consideration of services rendered as members of the International Jury, to Sciences, Agriculture, Industry, and the Beaux Arts, have decreed and do decree as follows:—

Art. 1. Are promoted or named in the Imperial Order of the Legion of Honour the members of the International Jury, whose names follow:—

FOREIGN JURY.

To be Commanders.—Lord Hertford; Encouragement given to the arts.—Lord Ashburton; Services rendered to commerce. *To be Officers.*—Sir David Brewster, Discoveries and works in optics.—Mr. Thomas Graham, Grand Master of the English Mint; Services rendered to science.—M. Von Dechen (Prussia), Director-General of the Mines of the Rhine; Great services rendered to science and manufactures.—Mr. Bazley, President of the Chamber of Commerce of Manchester; Extensive manufactures.—M. T. Hornbostel, President of the Chamber of Commerce of Vienna; Services rendered to commerce and manufactures.—M. Diergardt, Privy Councillor of Trade at Berlin; Services rendered to manufactures and to the working classes.—M. Grenier Lefebvre (Belgium), old decorated soldier under the Empire; Services rendered to commerce.—M. Waagen (Prussia); Painting. *To be Knights.*—M. Devaux, Inspector-General of Mines in Belgium; Services rendered in the management of mines.—Sir William Hooker, Director of the Royal Gardens at Kew; Important services rendered to natural sciences.—Baron de Riesc Stallburg, Member of the Council of Agriculture of Bohemia; Important works and improvements in agriculture.—Mr. Wilson, Professor of Agriculture at the University of Edinburgh; Remarkable collection of English agricultural productions.—M. Hartwich (Prussia), General Engineer of Railways.—Mr. Crampton, Engineer of the submarine telegraph; Invention of a locomotive of great speed.—Mr. Robert Willis, Professor of Natural Sciences at Cambridge.—M. Daniel Schmidt, ex Vice-President of the Chamber of Commerce of Vienna; Services rendered to manufactures.—M. Magnus (Prussia), Remarkable chemical works.—Mr. Wheatstone, Professor of Natural Philosophy at King's College; Application of the electric telegraph.—M. Stas, Member of the Royal Academy of Belgium; Remarkable chemical works.—M. D'Oliveira Pimentel, Professor of Chemistry at the Polytechnic School of Lisbon; Scientific works.—M. Seybel, Member of the Chamber of Commerce of Vienna; Services rendered to science.—M. Verdell (Switzerland); Improvements in the processes for preserving fresh vegetables.—M. Robert Florent, manufacturer at Sellowitz, in Moravia; Services rendered to the French in Austria.—M. De Rossins Orban, Vice-President of the Chamber of Commerce of Liege; Services rendered to the Jury.—M. Georges Hossauer (Prussia), goldsmith to his Majesty at Berlin; Interesting works in plating and gilding by galvanism.—Mr. Hoffman, Professor in London; Chemical operations applied to glass.—M. Fortamps, cotton-spinner at Brussels; Services rendered to the Jury.—Mr. Walter Crum, manufacturer at Glasgow; Perfection of his printing on cloth.—M. Labureux, cloth manufacturer at Verviers (Belgium); Services rendered to manufactures.—M. Offermann, cloth manufacturer at Brunn (Moravia); Services rendered to the cloth trade.—Mr. Gibson, Services rendered to manufactures and commerce.—M. Gustave Mevissen, President of the Rhenish Railway Company at Cologne; Services rendered to manufactures and to the Jury.—M. Seemann, linen manufacturer at Stuttgart; Services rendered to manufactures.—Mr. Digby Wyatt, architect; Services rendered to manufactures and to the arts, Establishment of Schools for Industrial Drawing.—M. Durst (Switzerland), Important manufacture of straw and felt; Services rendered to manufactures.—M. Louis Forster, Professor at the Academy of the Beaux-Arts at Vienna; Services rendered to manufactures.—Mr. Thomas Delarue (England), For the importance of his manufacture of paper and his numerous inventions.—M. Joseph Hellmesberger, Director of the Conservatoire Imperial at Vienna; Services rendered to the Jury.—Mr. Twining, For the initiative taken by him for the exhibition of articles of domestic economy; Services rendered to the working-classes.—Lord Elcho (England), Painting.

FOREIGN COMMISSIONERS.

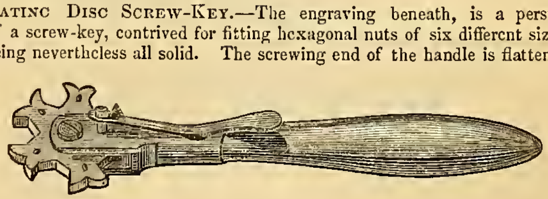
Officers.—MM. De Burg, Austria; Colonel Barman, Switzerland; H. Cole, England; Major Owen, England; Pescatore, Holland; Rainbeaux, Belgium; De Vievahn, Prussia. *Knights.*—MM. Brandstrom, Sweden; Bleymuller, Grand Duchy of Hesse; Caranza, Turkey; Corridi, Tuscany; Dielietz, Prussia; Dietz, Baden; Fowke, England; Ferrero, Sardinia; Geffken, Hanse Towns; De Hock, Austria; Lade, Grand Duchy of Nassau; Marshall Wood, America; Elias Mussali, Turkey; Redgrave, England; Schwartz, Austria; De Stein, Prussia, Suermondt, Holland; Schubarth, Bavaria, Spiliotakis, Greece; Tidemant, Norway; Valentine, America; Worms de Romilly, Belgium; Wattemare, America; Woldemar-Seyffarth, Saxony.

FRENCH JURY.

Commander.—M. Michel Chevallier, Councillor of State; Important works on industry and commerce. *Officers.*—M. Schlumberger, Valuable services rendered in the manufacture of cotton goods.—M. Mathieu, member of the Academy of Sciences; Remarkable works in astronomy.—M. Persoz Professor at the Conservatoire des Arts et Metiers; Important discoveries in natural philosophy and in chemistry applied to manufactures.—M. Goldenberg, steel tool manufacturer; Important improvements made in that manufacture, and services rendered to the working-classes.—M. Hittorff, Services rendered to the arts and manufactures,—M. Natalis Rondot, Services rendered to industry and commerce. *Knights.*—M. Adolphe Focillon, Professor of Natural History at the Lycee Louis-le-Grand, &c.; Services rendered to science.—M. Louis Vilmorin, Member of the Imperial Agricultural Society; Very important services rendered to agriculture.—M. Barral, Professor of Chemistry; Numerous scientific services.—M. Alfred Dailly, extensive agriculturist at Trappes (Seine-et-Oise); Remarkable agricultural operations; co-operation given to the Imperial Commission.—M. Alcan, Professor at the Conservatoire des Arts et Metiers; Remarkable works on spinning and weaving machines.—M. Brunner, Adjoint du Bureau des Longitudes; For the construction of his astronomical and other instruments.—M. Vertheim, Remarkable works of natural philosophy and acoustics.—M. Henri Bouley, Professor at the Veterinary School at Alfort; Works on the veterinary sciences.—M. Estivaut, Manufacturer in Metals at Givet, Ardennes; Improvements in alloyed metals.—M. Deveria, Conservator of prints at the Imperial Library; Services rendered to the arts.—M. Ernest Seillieres, Improvements in spinning and weaving cotton; Services rendered to the working-classes.—M. de Brunet, Services rendered to manufactures.—M. Adolphe Girdon, Member of the Chamber of Commerce of Lyons; Services rendered to manufactures.—M. Cohen, sen., spinner and manufacturer; Services rendered to manufactures.—M. Alphonse Payen, Services rendered to commerce and to the Jury.—M. Remquet, formerly a workman; Services rendered to the Jury.—M. Merlin, Conservator of the collections at the Ministry of State: Services rendered to the Jury.—M. Albert de St. Leger, Important works on industry and commerce.—M. Michel, Esteemed works on primary instruction, and services rendered to the working-classes.

Art. 2. Our Minister of State, our Minister of Agriculture, Commerce, and Public Works, and the Grand Chancellor of the Legion of Honour are charged, each as far as he is respectively concerned, with the execution of the present decree. Done at the Tuileries, the 14th of November, 1855, Napoleon, Achille Fould, E. Rouher.

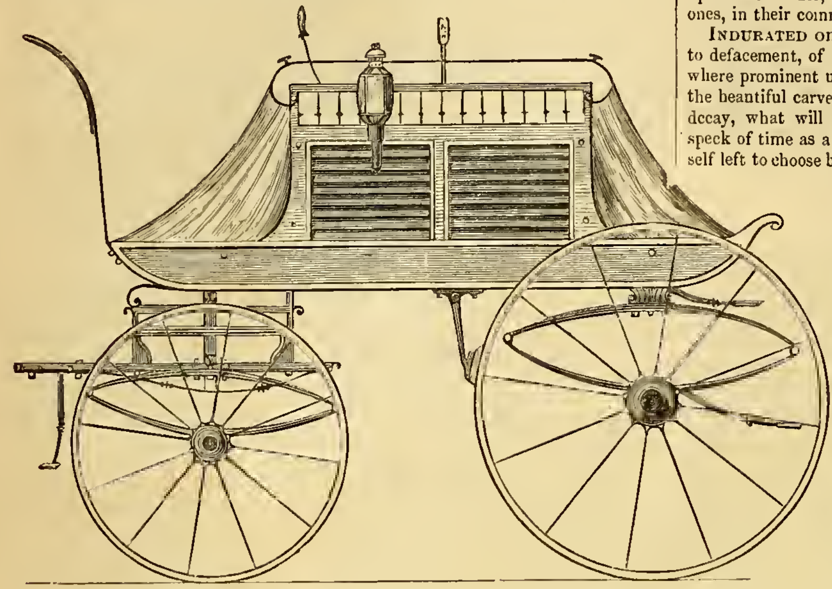
Rotating Disc Screw-Key.—The engraving beneath, is a perspective view of a screw-key, contrived for fitting hexagonal nuts of six different sizes. the jaws being nevertheless all solid. The screwing end of the handle is flattened out and slotted to form a double eye, with a stud centre to receive a metal disc, having round its periphery a set of six solid screwing jaws—regular gradations of size suited for the workshop. Opposite each jaw aperture is a small perforation in the disc, for the reception of a retaining pin when the disc is to be set for the action of any particular jaw. The upper side of the lever has a spring thumb-piece jointed upon it, and the longer arm of this thumb-piece carries a transverse pin, as before alluded to; this pin being entered through a hole in the double eye, at a point corresponding with the ring of holes in the disc. The spring of the thumb-piece has a constant tendency to keep the pin down for detaining the disc in a



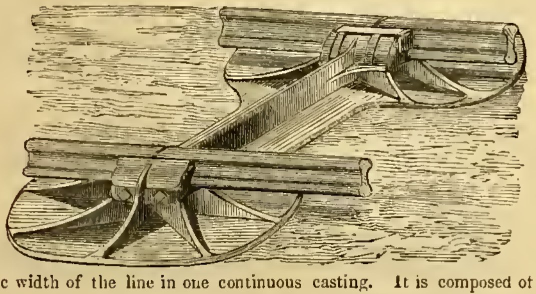
determined position; and when a new jaw is wanted, the pressure of the operator's thumb at once releases the disc for a new set.

Bertram's Mode of Joining Plate Iron.—A process, reminding us of Delbruck's "autogenous soldering" for pipes, has just been proposed by Mr. Bertram, a Woolwich engineer, for uniting plate iron instead of riveting. The two contiguous edges of the plates to be joined, are brought up to a fusing heat, and they are then simultaneously struck on both sides. The plan is under the consideration of Government, with the view of adopting it in ship-building and boiler-making.

Thomson's Sleigh Dog Cart.—Mr. William Thomson of Perth, well known as a "dog cart" builder, has introduced an ingenious and handsome form of four-wheeled dog cart, the body of which, detached from the wheels, resembles a sleigh. Our engraving represents this vehicle in complete side elevation, on a scale of 1-24th the real size, but with the pole or shafts removed. The body is double-seated, with a central back, after the manner of an ordinary dog cart, the pattern and general contour and form being alike on each side of the transverse centre. It is carried upon a pair of large hind-wheels, and a smaller pair of front wheels, forming a very elegant carriage of extreme lightness. It is fitted up with aprons and mountings for both back and front seats, in exact correspondence; and it is so contrived behind, that ladies may step in and out of it without bringing their dresses into contact with the wheels. It can, of course, be made either with or without a curve for the locking of the front wheels. When the body is detached from the wheels and their appurtenances, and placed upright on the ground, it forms a complete double-seated sleigh, both back and front at the bottom being curved upwards and shaped sleigh fashion. Our readers may form their opinions upon its appearance as a carriage for four sitters, from our sketch.



Bed-Plate Tie Railway Sleeper.—Since our previous notices of Mr. Wright's "vice-jaw" rail fastening, the inventor has added an expanded or bed-plate sleeper, as shown in our perspective sketch. This sleeper stretches across the whole width of the line in one continuous casting. It is composed of seven parts only—a compound sleeper, two vice-jaws, and four locking bolts. The example which we have given is that of a joint chair sleeper, holding the four ends of the rails, retaining them firmly in guage, and preventing all lateral and vertical motion whatever, whilst the wide base affords peculiar solidity.



American Metal-Working Machinery.—The extent to which mechanical contrivances are adopted in America, for the performance of what is here ordinarily left to the dexterity of the hand, always surprises the British visitor, who seldom returns from the New World without many accumulations of mechanical experience. An attempt is now making in Glasgow to engraft some of the more useful of the Americal tools for ordinary work upon British soil. The introducer of these tools is Mr. James Smith, who acts principally for the proprietors of the Mattabesett Works in Connecticut, in bringing forward their tin and iron plate working machines. Amongst these is an ingenious and most serviceable folding or edge-turning tool for bending round the edges of metal plates. This is nothing more than a horizontal turning bar, supported in bearings at the ends, and carrying a nipping strip for the admission of the edge to be turned. The bar is actuated by a lever handle having two motions—one in the direction of the bar's length, and the other transversely. The first fastens the edge, and the second turns it over to any form. The tool is well adapted for pipe-making, as well as for flat work. An equally valuable contrivance is a rotatory shearer for circular work, fitted up in combination with edge-folding, grooving, and wiring apparatus. With this a truly circular plate can be rapidly cut out, and the edge afterwards turned over with the greatest accuracy, to any form. Another important feature of these tools is, that arrangements are made for setting up a great variety of small implements upon one holder, so that small shops may stand almost on a level with larger ones, in their command of tools.

Indurated or Hardened Stone.*—The premature decay and the liability to defacement, of all our easily workable natural building stones, are evils everywhere prominent upon the architectural face of the country. If the soft edges of the beautiful carved work in the new Houses of Parliament already exhibit signs of decay, what will be the fate of that magnificent building within even such a speck of time as a few years? Without some artificial aid, the builder finds himself left to choose between a material which is only tractable under the mason's tools because it is unenduring, and one which withstands the ravages of time only in virtue of its defying the efforts of the artificer. The process originally patented by Mr. W. Hutchison of Tunbridge Wells, and now carried vigorously on by the "Indurated Stone Company," removes the difficulty by giving the stone-worker the power of making any stone indestructibly hard after it has been worked to form, so that he need not hesitate to employ stones which are naturally too soft for structural purposes. This hardening is effected by merely dipping the stone in a prepared solution of bituminous or resinous matter. The bitumen imparts a dark tint to the stone; but if this is undesirable, the resin which does not discolour may be used. Sir Roderick Murchison, who, as a geologist, ought to know something of stone, says, that when thus prepared, soft stone becomes "an indestructible rock, with edges only to be destroyed by violence, and can never be affected by weather." The bituminous induration costs about 4*d.* per cubic foot, and the resinous treatment about 1*s.* 4*d.*; these prices refer to the thorough saturation of the stone, which is not necessary in thick masses, a superficial hardening being quite sufficient; grindstones hardened in this way are extremely lasting. The same company makes an "artificial compressed stone," a composition of sand, loam, chalk, and gravel, shingle, plaster, lime, and cement, with resinous and bituminous matter. This produces a hard stone impervious to moisture, whilst the nature of its manufacture permits of its being moulded even into intricate forms.

Peninsular and Oriental Steam Navigation Company.—The steam fleet of the Company actually employed by it in the conveyance of passengers and goods, consists of thirty-two vessels, ranging from a tonnage of 2,200 and a horse-power of 500, to a tonnage of 300 and a horse-power of 80. The total horse-power is 10,220, and the total tonnage 36,230. Of these vessels, twelve are furnished with screws and the rest with paddles. Three steamers are confined to the route between Southampton and Gibraltar, five connect Southampton with Alexandria, and two connect Marseilles with Malta. On the other side of the Isthmus of Suez, twenty steamers are employed. Of these, six ply between Suez and Calcutta, calling at Ceylon and Madras; three link Aden with Bombay; five connect Bombay and Hong Kong; four voyage between Calcutta and Hong Kong; and three are employed on the Chinese coast, between Hong Kong and Shanghae. The Pasha of Egypt undertakes the conveyance of passengers from Alexandria to Suez in sixty hours, allowing them one night's rest. The first sixty miles are performed on the railway which connects Alexandria with the Nile. Eighty miles of steaming on the Nile bring passengers to Cairo; and then eighty miles of desert are crossed to reach Suez, this part of the journey being performed in carriages. Starting from Alexandria, it is reached in fourteen days, the distance being 2,951 miles. From Suez to Bombay is a distance of 2,972 miles; from Suez to Calcutta, 4,757 miles; from Bombay to Hong Kong, 3,104 miles; from Calcutta to Hong Kong, 3,104 miles; and from Hong Kong to Shanghae, 800 miles. In addition to the fleet of steamers above referred to, the Company possesses seven steamers, six of which are screws, employed in the Government transport service. The largest is the *Simla*, with a tonnage of 2,440, and a horse-power of 630. The total tonnage of these seven vessels is 11,496, and the total horse-power 2,570.

MARINE MEMORANDA—PROGRESS OF SCREW PROPULSION.

Two steamers have just been built by Messrs. Scott, Russell, & Co., from the designs of a Mr. Hans Busk, who has achieved some great novelties in naval architecture. These ships are a yacht, the *Meriel*, and her tender, the *New Quarterly*, and they have been devised as a practical contrast of proportions, being of the same beam, but utterly different in other respects. The yacht is 166 feet long, with a breadth of 16 feet. She measures 215 tons, and has a bow with a long sharp hollow entrance. Her tender is only 106 feet long, measuring 120 tons, and having a particularly bluff bow; but both have 60 horse engines. In the Long Reach test, the yacht's rate was close upon 12 knots an hour, whilst that of her tender was 9½ knots. The yacht, which was launched with steam up, and went to work as if she had been accustomed to it, is a most beautiful model, and must attract great attention amongst naval engineers. Neither vessel draws much above two feet of water, Mr. Busk's intention having been the coming to some decision as to the lines proper for vessels suitable for manœuvring in shallow water. The decision of the Board of Trade on the subject of water-tight bulkheads, as elicited by the Messrs. Burns of Glasgow, is important. The following letter and memorandum explains itself:—

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* See also page 262, Vol. I., *P. M. Journal.*

Office of Committee of Privy Council for Trade,
Marine Department, November 3, 1855.

Gentlemen,—I am directed by the Lords of the Committee of Privy Council for Trade to acquaint you that my Lords have had under their consideration the memorial signed by yourselves and other iron shipbuilders and steamship owners on the Clyde, relative to the water-tight partitions in iron vessels, required by the Merchant Shipping Act, 1854, more particularly with reference to iron screw steamers; and I am to transmit to you the accompanying copy of the additional instructions which my Lords have issued to their surveyors, for regulating the construction of the shaft trunks in iron screw steamers.—I am, gentlemen, your obedient servant, JAMES BOOTH.

Messrs. G. & J. Burns, Glasgow.

Memorandum.—Shaft Trunks in Screw Steamers.

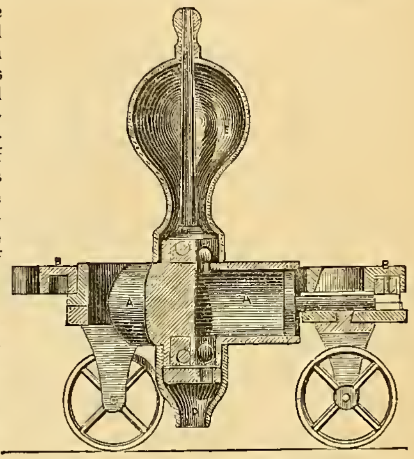
Instructions to Surveyors of Steam Vessels (by way of addition to Paragraph 57 of Original Instructions).—As it appears to my Lords that, in the case of iron screw steamers, inconvenience may arise from a rigid adherence to the rule, that no communications are to be allowed in parliamentary bulkheads, my Lords are pleased to direct that, in all cases where the owners require it, an access may be afforded from the engine-room through the parliamentary bulkhead to the shaft trunk as follows:—The end of the trunk, in such cases, is to be fitted to the after part of the bulkhead, so as to be perfectly water-tight. The trunk itself is to be of equal strength with the bulkhead, and also water-tight throughout; the end of the trunk next the engine-room is to be fitted with a stuffing-box for the shaft to pass through. An entrance is to be made through the bulkhead into the trunk, just large enough to enable a man to enter from the engine-room to look after the bearings. This opening must be constructed with a water-tight sliding door, working in a groove, which may be opened or closed by a rod from the deck above. When there is no trunk, a water-tight stuffing-box must be fitted at the place where the shaft passes through the bulkhead.—*October* 26, 1855, *Board of Trade.*

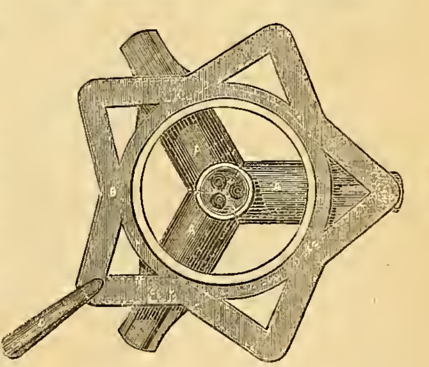
WORKING COSTS OF RAILWAYS.—The notes which we have given, from time to time, upon the relative costs of working our railways, have thrown a good deal of light upon the various causes and effects at work in railway management, as affected by locality and system. We are now enabled to give further insight into this subject, by a comparative development of the aggregate working costs of the mass of British lines. For the year 1854, the entire working expenses of railway companies in the United Kingdom amounted to £9,206,205, or 45 per cent. of the receipts, which were £20,407,148. On railways in England and Wales, the expenses amounted to £7,870,487, or 45 per cent. of the receipts (£17,543,611); in Scotland to £948,119, or 43 per cent. of the receipts (£1,979,327); and on railways in Ireland to £387,597, or 46 per cent. of the receipts (£834,810). The expenses under the head of "maintenance of way and works" amounted, for railways in the United Kingdom, to £1,352,157, or 14·68 per cent.; of the total expenses, the locomotive power, including rolling stock, to £3,702,014, or 40·21 per cent.; the traffic charges to £2,338,976, or 25·41 per cent.; the miscellaneous, including policemen, watchmen, compensation, &c., to £1,122,078, or 12·19 per cent.; and the rates and taxes, and government duty, to £690,980, or 7·51 per cent. of the total expenses. The maintenance of way and works on railways in England and Wales, for the year 1854, cost the companies £1,145,040, or 14·55 per cent. of the total working expenses; in Scotland, £150,670, or 15·90 per cent.; and in Ireland £56,447, or 14·57 per cent. The locomotive power, including the repairs, &c., of rolling stock, amounted on railways in England and Wales to £3,121,820, or 39·67 per cent.; in Scotland to £406,456, or 42·88 per cent.; and in Ireland to £173,738, or 44·82 per cent. The traffic charges on railways in England and Wales amounted to £2,054,187, or 26·09 per cent. of the expenses; in Scotland to £194,260, or 20·49 per cent.; and in Ireland to £90,529, or 23·36 per cent. The miscellaneous expenses, including policemen, watchmen, compensation, &c., amounted on railways in England and Wales to £913,577, or 11·61 per cent. of the expenses; in Scotland to £151,757, or 16·01 per cent.; and in Ireland to £56,744, or 14·64 per cent. The rates, taxes, and government duty on railways in England and Wales amounted to £635,863, or 8·08 per cent. of the working expenses; in Scotland to £44,976, or 4·72 per cent.; and in Ireland, for rates and taxes only—there being no government duty—to £10,141, or 2·62 per cent. of the working expenses.

IRISH SUNFISH OIL.—The great Irish Exhibition of 1853 afforded us the opportunity of inquiring into the cause of Ireland's mismanagement of her fisheries, especially as regards the valuable sunfish. A pamphlet just issued by Commander Symonds, now tells us that what the private enterprise of the country has failed to accomplish, has been taken up by a company. In this way the London market will at length draw large supplies of fine fish from the Irish western coast. A steamer is about to be put upon the station, so as to insure speed and regularity in the conveyance of the perishable cargoes from the scattered fishing grounds to the scene of consumption. The sailing vessels to be used in actual fishing are of about 80 tons; whilst, for drift-net fishing, vessels of about 25 tons will be used, and long narrow row-boats are to be put on for bay and channel use. For the in-shore turbot banks canoes are to be employed. The fish expected to be taken in large quantities are, cod, ling, skate, conger eels, haddock, mackerel, sunfish, herrings, turbot, and varieties of shell-fish. When we remember that, at the time we formerly wrote—1853—Ireland had to import for her own use some 100,000 barrels of herrings from Scotland alone, and that the Galway tribes actually ate the cod of Newfoundland, we have room for much gratifying contemplation upon the new undertaking.

THE PRACTICAL MECHANIC'S JOURNAL IN RUSSIA.—A late number of the *Journal de St. Petersbourg* gives a list of the European journals and periodicals which will be on sale in the ensuing year, at the establishment of the Government bookseller. The French journals are one hundred and eighty-one in number, the English *thirteen*, and the German sixty-one. The English are as follows:—"The Art-Journal," "Athenæum," "Blackwood," "Lady's Magazine," "Children's Magazine," "Curtis's Botanical Magazine," "Edinburgh Review," "Illustrated London News," "Lady's Newspaper," "Little Child's Pictorial Magazine," "Mechanic's Magazine," "*Practical Mechanic's Journal*," and "Sharp's London Magazine." It thus seems that the Czar finds time, even now, to acquaint himself with our pages.

COMBINED TRIPLE CYLINDER FIRE-ENGINE.—An ingenious fire-engine, or water-jet pump, of three cylinders working in concert, has recently made its appearance in America. It is represented in sectional elevation and plan in the annexed engravings. It consists of three horizontal cylinders, A, radiating from a centre, where they are all united by their ends. These cylinders are fitted with solid pistons, the rods of which radiate far enough outwards to reach the angular-grooved cam-piece, B. Each piston-rod carries a small roller, fitting the differential groove of the rotatory cam, which is fitted to work round upon a ring centre-piece. Any number of handles, C, may be attached to the periphery of the cam, and the firemen, each taking a lever, work round the centre, so that the cam action causes a continual reciprocatory traverse of the pistons. The water is taken in by a central branch, D, beneath; and passing through the usual ball valves, it is injected into the central air-vessel, E, above, whence it passes off by a jet in the usual way.





SELF-ADJUSTING CARRIAGE WINDOW-FRAME.—The bad fitting of carriage window-frames, whether in a first-class railway carriage or a street cab, must be obvious to every reader of these pages. True enough, something has lately been done to mitigate the evils of sticking, rattling, and permeability to the weather; but, on the average, we have the same defects which have haunted all travellers these twenty years. Mr. William Blackford, of the firm of Cooper, Blackford, & Co., of Long Acre, has done something further in the matter, by bringing out his self-adjusting frame, fixable at any height, without either a fastening or holes in the glass string. The sliding window-frame carries a set of vertical teeth, concealed by the beading in the carriage body. A locking piece in the latter affords the means of setting a detent in or out of these teeth at pleasure. The window is raised in the usual way by the glass string, and when it is wanted to descend, the finger pressure upon the retaining lock allows it to fall. The fittings are simple and easily manageable under all circumstances.

THE ROYAL SOCIETY PRIZES.—M. Leon Foucault has this year carried off the Copley Medal of the Royal Society, in virtue of his valuable researches in Experimental Physics. Mr. J. R. Hind, has gained a Royal Medal by his discovery of ten Planetoids, the computation of their orbits, and other astronomical discoveries; and Mr. J. C. Westwood, the president of the Entomological Society, the other, for his monographs and papers on Entomology. We are glad to be able to state, that Government has announced the continuance of the £1000 grant to the Society for scientific purposes.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded June 20.

1405. William C. Holmes, Huddersfield—Improvements in the manufacture of gas and in apparatus employed therein.

Recorded July 21.

1650. Alfred Tooth, 14 Mincing-lane—Invention of a process for preserving and curing by salting the flesh and hides of animals in an entire state.

Recorded July 26.

1693. Christian Schiele, Oldham—Certain improvements in obtaining and applying motive power.

Recorded July 31.

1737. George J. Dalman, Alfred-villas, Enfield-road, Kingsland—An improvement in the manufacture of glazes for earthenware.—(Communication.)

Recorded August 21.

1890. George Lewis, High Cross-street, Leicester—Improvements in gloves, cut out with a knife and rotary press.

Recorded August 23.

1911. William L. Thomas, Chapel-place—Improvements in projectiles.

Recorded August 25.

1931. Honoré le François, Vauxhall—Invention of an apparatus for cleaning stewpans and other similar culinary utensils.

Recorded September 8.

2032. Robert B. Feather, Liverpool—Improvements in the make and construction of shells and balls to be used with cannon, or other artillery, or fire-arms.

Recorded September 15.

2081. Paul F. Wohlgemuth, 57 New Bond-street, Hanover-square—Invention of the construction of bridges.
2083. Henry Chandler, Birmingham—Improvements in roasting jacks.
2085. David Hill, Ocker-hill, Tipton, Staffordshire—Invention of preparing a material capable of resisting fire, and especially suitable for the interior of puddling and other furnaces.
2087. George Hamilton, Great Tower-street—Improvements in apparatus for weighing.
2089. Lewis D. B. Gordon, Abingdon-street—An improvement in electric telegraphs when insulated wires are laid under water or in the earth.—(Communication.)

Recorded September 17.

2093. Uriah Scott, Duke-street, Adelphi—Certain improvements in the construction of vehicles and the various parts of the same.
2095. Edward Gibbs, Wolverhampton—A new or improved manufacture of picture frames, vases, busts, and such articles as are or may be produced by the process of moulding.
2097. Noah Turner, Chorley, Lancashire—Certain improvements in the manufacture known as "gold wire" and "gold plate," for the production of "gold thread" or "gold lace."
2099. George Copland, Liverpool—An improved fluid compound for the destruction of bugs and other insects.
2101. Jean H. Destibeaux, Paris—An improved waterproof fabric.
2103. Charles T. Bright and Edward B. Bright, Liverpool—Improvements in electric telegraphs, and in apparatus connected therewith.

Recorded September 18.

2104. James Dellagana, 61 Red Lion-street, Clerkenwell—Invention of stereotyping type high; that is to say, as high as common printing-type, or seven-eighths of an inch high.
2105. John J. Halcombe, Magdalen College, Cambridge—Improvements in the means of obtaining skeleton maps for educational purposes.
2107. Pierre G. Barry, Gray Town, France—Improvements in treating bituminous shale, boghead mineral, and other like schistous bodies, in order to obtain various commercial products therefrom.
2109. Alfred V. Newton, 66 Chancery-lane—An improved construction of paddle-wheel, and an improved mode of mounting such wheels.—(Communication.)
2111. James Willis, Cheapside—Improvements in the construction of umbrella and parasol furniture.

Recorded September 19.

2113. George A. Biddell, Ipswich—Improvements in railway crossings.
2115. William R. Lomax, Hammersmith—Improvements in steam engines.
2117. John H. Linsey, 12 Pilgrim-street, Ludgate-hill—Certain improvements in account books and other large books.

Recorded September 20.

2119. John Page, Perth, and William Robertson, Dundee—Improvements in moulding or shaping metals.

Recorded September 21.

2121. Asa Lees and John Glegg, Soho Iron Works, Oldham—Certain improvements in looms for weaving.
2123. George S. Parkinson, 14 Devonshire-terrace, Kensington—Improvements in railway breaks.

Recorded September 22.

2125. William Pollitt, Clayton-le-Dale, and James Eastwood, Blackburn—Improvements in apparatus for churning milk and mixing liquid compounds.

Recorded September 24.

2127. David Chalmers, Manchester—Improvements in machinery or apparatus for cutting the pile of woven fabrics.
2129. Joseph Beattie, 11 Lawn-place, South Lambeth—Improvements in furnaces and boilers for the generation of steam, and in apparatus for the application and treatment thereof.
2131. Henry J. Harcourt, Bristol-street, Birmingham—Certain improvements in bell cranks and other parts of bell furniture.
2133. George R. Hudson, 120 London-wall—An improved coffeepot.—(Communication.)
2134. John Musto, East London Iron Works, Cambridge-road, Mile-end, and Frederick Bear, 43 Northampton-street, Mile-end—Improvements in machinery for the manufacture of tobacco.
2135. Alfred V. Newton, 66 Chancery-lane—An improved mode of casting solid and hollow articles in metal.—(Communication.)

Recorded September 25.

2137. John L. Gardner, Providence-street, Walworth—Improvements in the manufacture, form, and mode of attaching buttons.
2139. Joseph C. Clive, Birmingham—Improvements in photography.
2141. Etienne Laport, Paris—Certain improvements in the manufacture of candles.
2143. John Roberts, Upnor, Kent—Improvements in the manufacture of cements.

Recorded September 26.

2145. Richard Crankshaw, Blackburn—Certain improvements in machinery or apparatus for sizeing or otherwise preparing warps for weaving.
2147. Felix Bouchet, Paris—An improved mechanical arrangement for elevating or lowering and moving forward or backward heavy or submerged bodies.
2149. Malcolm W. Hilles, Percy-street, Bedford-square—An improved construction of rack for window blinds.

Recorded September 27.

2151. Henry Hughes, Loughborough, Leicestershire—Improvements in the means of compensating for the wear of machinery subject to rectilinear motion.
2153. Anaxagor E. Guilbert and Charles L. Guillemère, Paris, and 32 Essex-street, Strand—Invention of a new system of bridle for leading and overruling fiery horses.
2155. François X. Poignard, Paris—Improvements in the manufacture of wedges and keys.—(Communication.)
2157. Charles V. Théry, London—Invention of a new preparation of coffee.

Recorded September 28.

2159. Thomas Dyke, Long Newton, near Darlington—Improvements in grass cutting machines.
2161. William D. Gray, 1 Clifton-road, Old Kent-road—Invention of an apparatus or instrument for showing the course or direction and distance run by a ship at sea.
2163. Richard L. Johnson, 12 Cabra-terrace, Dublin—Improvements in the manufacture of gas for illumination from peat or other substances, and in the apparatus employed in such manufacture.
2167. Edward D. Thomson, Duke-street, St. James'—Improvements in generating heat in steam-boiler furnaces.

Recorded September 29.

2169. George Adamson, Leith-street, Edinburgh—Invention of a travelling staging and crane or jenny, adapted for building piers and other harbour works.
2171. Joseph Mitchell, Sheffield—Improvements in buffers and draw springs used for railway and other purposes.
2173. David Chadwick, Salford, Herbert Frost, George Hanson, and John Chadwick, Manchester—Improvements in apparatus for measuring water and other fluids and gas, applicable also as a motive power engine.
2175. Joseph Beattie, 11 Lawn-place, South Lambeth—Improvements in the construction of railway wheels and axles.

Recorded October 1.

2177. John Gedge, 4 Wellington-street South, Strand—Improvements in gas meters.—(Communication.)
2179. William Illingworth, Manchester—Certain improvements in printing earthenware, china, and other ceramic manufactures.
2180. Charles Radcliffe, Sowerby Bridge, Yorkshire—Improvements in apparatus for moistening or damping woollen or other textile fabrics for finishing.
2181. Auguste E. L. Bellford, 32 Essex-street, Strand—Improvements in ventilating hats or coverings for the head.—(Communication.)
2183. John Mitchell, Dunnings-alley, Bishopsgate-street Without—Improvements in apparatus for washing and amalgamating ores and other matters.
2184. William Kempe, Holbeck Mills, Leeds—An improvement in machinery for raising the pile on woollen and other cloths or fabrics.
2185. James H. Deming, New York, now residing at Paris—Improvements in the construction of projectiles.—(Communication.)
2187. George Baker, 149 High-street, and Charles Miller, Flying-horse-yard, Southwark—Improvements in the construction of register stoves.
2189. Capt. Franz Uchatius, Vienna—An improvement in the process of manufacturing cast steel.
2191. John R. Musgrave, Robert Musgrave, and James Musgrave, Belfast—Improvement in stoves for cooking and heating.

Recorded October 2.

2193. James Chadwick, Bank-wood, Charlesworth, near Glossop, Derbyshire—Certain improvements in machinery for carding cotton and other fibrous materials.
2195. George Rennie, Holland-street, Blackfriars—Improvements in steam engine boilers as applied to the propulsion of vessels.
2199. William E. Newton, 66 Chancery-lane—An improved mode of constructing elastic bed bottoms, applicable also to sofas, settees, and other seats.—(Communication.)
2201. George T. Bousfield, Sussex-place, Loughborough-road—Improvements in locks for fire-arms.—(Communication.)
2203. Richard Peyton, Brodesley Works, Birmingham—An improvement in the manufacture of fences and gates where wrought-iron is used.

Recorded October 3.

2205. Thomas Greaves, Manchester—Improvements in the method or means of obtaining and employing motive power.
2207. Richard A. Brooman, 166 Fleet-street—Invention of a new method of ascertaining or indicating and regulating the height of water in steam boilers.—(Communication.)
2209. Robert Wilkinson, Staley Bridge—Improvements in machinery or apparatus for carding cotton, wool, and other fibrous substances.

Recorded October 4.

2211. Robert A. Crosse, Bartholomew-lane, Bank—Certain improvements in founding printer's type.
2213. George F. Gruet, Bordeaux, France—An improvement in the construction of lamps.
2215. Henry Cornforth, Birmingham—A new or improved manufacture of hooks and eyes.
2217. Frederick G. Sanders and Thomas R. Sanders, jun., Poole—Improvements in the manufacture of pottery, earthenware, and other clay articles.
2219. William Hamilton, St. Helen's-lodge, Hampshire—Improvements in the construction of tables, chairs, sofas, and other articles of furniture.
2221. Henry Brierly, Chorley, Lancashire—Improvements in self-acting mules for spinning.
2223. Françoise M. Demait, Paris, and 4 South-street, Finsbury—Certain improvements in the preservation of animal and vegetable substances.

Recorded October 5.

2225. Thomas Grahame, Elmhurst-hall, Lichfield—Improvements in the construction of floating batteries or vessels in order to render them ball and shot proof.

2227. William Spence, 50 Chancery-lane—Improvements in cards for carding cotton and other fibrous substances.—(Communication.)

2229. Joseph B. Howell, Sheffield—Improvements in the manufacture of steel castings for ordnance and other purposes.

2231. Eliza C. Wren, Tottenham-court-road—An improved construction of child's cot.

Recorded October 6.

2233. William J. Roffe, Upper Holloway, Middlesex—Improvements in stoves or furnaces.

2235. Benjamin Hoyle, Stand, in Pilkington, Lancashire—Certain improvements in the process of dyeing.

2237. James T. Hester, Oxford—Improvements in invalid and children's chairs.

2239. William Rogers, New-road, Whitechapel-road—Improvements in fire-arms.

Recorded October 8.

2241. John Denner, 11 Albion-grove West, Islington—Improvements in furnaces for the consumption of smoke, drying tan and other similar substances.

2243. William Rothera, Hollins, Lancashire—Certain improvements in machinery or apparatus for manufacturing bolts, screw blanks, rivets, and other similar articles.

2245. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the method of, and apparatus for, rolling iron, more particularly applicable to the manufacture of the tyres of railway wheels.—(Communication from Jackson Brothers, Petin, Gaudet, & Co., Rive de Gier and St. Chamond, France.)

2247. William E. Newton, 66 Chancery-lane—Improvements in condensers.—(Communication.)

Recorded October 9.

2248. Robert Willan and Daniel Mills, Blackburn—Improvements in looms.—(Communication.)

2249. Perceval M. Parsons, Duke-street, Adelphi—Certain improvements in connecting and securing the joints of pipes and tubes.

2250. Joseph G. Martien, Newark, New Jersey, U.S.—Improvements in the manufacture of iron and steel.

2251. William C. Jay, Regent-street—An improved manufacture of collapsible hat or bonnet.—(Communication.)

2253. James Murdoch, 7 Staple Inn—Improvements in extracting colouring matter from lichens containing such colouring matter.—(Communication.)

2254. James Murdoch, 7 Staple Inn—Improvements in extracting colouring matter from lichens containing such colouring matter.—(Communication.)

2255. Julien F. Belleville, Paris—An improved smoke consuming apparatus.

2256. Etienne F. Vion, Paris—An improved tea or coffee pot.

2257. William H. Lancaster, 24 Hatfield-street, and James Smith, Sefton-street, Toxteth-park, both of Liverpool—Invention of consuming smoke, and for generating and diffusing heat in furnaces, and in furnace or other flues.

2258. Stephen Goldner, Wimpole-street—Improvements in apparatus used in cooking and preserving animal and vegetable matters.

2259. Narcisse Leroy, Paris—Improvements in the construction of railway carriages.

Recorded October 10.

2260. John Onions, 44 Wellington-place, Blackfriars-road, Southwark—Invention of a certain mode of collecting and means of applying for use the smoke, heated air, and other gases arising from engine and other furnace fires.

2261. John Gedge, 4 Wellington-street South, Strand—Improvements in machinery or apparatus for placing on card drawings used in various manufactories.—(Communication.)

2262. Thomas Fairbairn, William A. Fairbairn, and George Fairbairn, Manchester—Improvements in the mode or method of casting ordnance, which improvements are also applicable to casting cylinders and other similar vessels.

2263. Richard W. Pyne, Southwark, and William Malam, London-road—An improvement in the manufacture of gas.

2264. William E. Newton, 66 Chancery-lane—Improved machinery for dressing flour.—(Communication.)

2265. John Parry, Lower Broughton, and Samuel Ivers, Salford—Certain improvements in looms for weaving.

2266. Thomas Oddie, William Lancaster, and John Lancaster, Preston—Certain improvements in looms for weaving.

2267. John Thornton, Albert Thornton, William Thornton, and Henry Thornton, Nottingham—Improvements in machinery for the manufacture of looped or knitted fabrics.

2268. Denis Hébert, 28 Rue Marbeuf, Paris—Improvements in heating and arranging ovens.—(Communication.)

2269. William C. Taylor, 11 Devonshire-road, Greenwich—Improvements in marine-steam engines.

Recorded October 11.

2270. Ramsay R. Reinagle, 12 King William-street, Strand—Improvements in barrows, hand-trucks, and other similar vehicles.

2272. Joseph Gilpin, Leeds—An improved "raising-gig" to be employed in the manufacture of woollen cloths.

2273. William A. Fairbairn and George Haslam, Manchester—Improvements applicable to locomotive engines and carriages.

2274. William Bayley and John Quarmby, Stalybridge—Improvements in machines for carding cotton and other fibrous materials.

2275. Peter Spence, Pendleton, Lancashire—Improvements in the production of sulphate of alumina to be used in the fluid state, or to be rendered into the solid condition, known commercially as cake alum.

2276. William B. Adams, 1 Adam-street, Adelphi—Improvements in machinery and tools for cutting and carving wood and other materials.

2277. John K. Westrop, Staining-lane, and Edward A. Sharman, 35 Noble-street—An improvement in the manufacture of gloves made of looped fabrics of silk, cotton, and linen.

2278. Richard A. Tilghman, Philadelphia, U.S.—Improvements in treating fatty and oily substances.

Recorded October 12.

2280. Francis Puls, Soho-square—Improvements in electro-coating metals, or alloys of metals, with other metals or alloys of metals.

2281. Robert H. Kay, Alfred T. Richardson, and George Mallinson, Manchester—Improvements in the manufacture of plain and ornamental woven fabrics.

2282. Thomas Moore, Retford, Nottinghamshire—An improved mill for grinding corn and other grain.

2283. William Lyall, Amiens, France—Improvements in spinning machinery, applicable also to roving machinery.

2284. Cornelius Ward, 36 Great Titchfield-street, Marylebone—Improvements in the construction of the musical instruments designated clarionets.

2285. Henry Gardner, Oldner Farm, Chipping Norton—Improvements in machinery for dressing or cleaning wheat, grain, and seeds.

2286. John Livingston, Leeds—Improvements in certain parts of the permanent way of railways.

2287. Adolph Staadt, Brussels—Improvements in obtaining motive power when gravity and steam or expansive fluids are used.—(Partly a communication.)

Recorded October 13.

2288. James S. Cockings and Ferdinand Potts, Birmingham—Certain improvements in sockets for whips and candles, parts of which are also applicable to the sockets or irons for holding carriage and other lamps.

2289. Hugh Greaves, New Palace-yard—Improvements in the construction of steam boilers.

2290. Germain A. Thibierge, Versailles—Certain improvements in manufacturing chlorine, part of which are applicable for obtaining certain accessory products.

2292. William G. Eavestaff, Great Russell-street—Improvements in the construction of pianofortes.

2293. Louis Ullrich, Prague, Bohemia, and 4 Trafalgar-square, Charing-cross—Improvements in the means of indicating the number of persons entering an omnibus or other carriage, any theatre, or other building.

2294. John Moseley, Birmingham—Certain improvements in machinery for cleansing linen and other fibrous materials.

2295. Thomas and William Hemsley, Melbourne, near Derby—An improvement in the manufacture of embossed and craped fabrics.

2296. George T. Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in power-looms.—(Communication.)

2297. Manuel P. Lozano, Crutched Friars—Improvements in treating pyrites and ores containing sulphur, in obtaining sulphuretted hydrogen, and in precipitating copper from solutions.—(Communication.)

2298. George T. Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in looms suitable for weaving wire fabrics.—(Communication.)

2299. John Stenhouse, 15 Upper Barnsby-street, Islington—Improvements in the preparation of decolourising materials.

Recorded October 15.

2300. Charles Leftwich, 21 Munster-street, Regent's-park—Improvements in water-closets.

2302. Thomas W. Dodds, Holmes Engine and Railway Works, Rotherham—Improvements in fire-arms and ordnance, and in the projectiles to be used therewith.

2303. Samuel Kent, Liverpool—Improvements in purifying and measuring water, parts of which are applicable to measuring other fluids.

2304. Robert Benton, Birmingham—Improvements in obtaining motive power by leverage.

2305. James M. Brown and Thomas Brown, 165 Piccadilly—Improvements in the manufacture of folding chairs.

2306. Enrico A. L. Negretti and Joseph W. Zambra, Hatton Garden—Improvements applicable to self-registering guages, thermometers, barometers, and other mercurial meteorological instruments.

Recorded October 16.

2307. Lewis Normandy, 67 Judd-street, Brunswick-square—Improvements in the mode of writing and printing music, to facilitate the study thereof.—(Communication.)

2308. George Thomson, Glasgow—Improvements in steam-engines.

2310. William Church, Birmingham—An improvement or improvements in the manufacture of ordnance.

2311. Edwin Wilkinson, Woodhouse, Yorkshire—An improved mode of extracting grease from woollen, cotton, and worsted waste.

2312. John Forrest, Dears-place, Somers'-town—An improved mode of extracting metals from their ores.

2313. William E. Newton, 66 Chancery-lane—Improvements in the construction of fire-arms.—(Communication.)

2314. Théodore A. Claeijs, Bruxelles, Belgium—Improvements in the manufacture of corks and bungs.

Recorded October 17.

2315. James Fraser, Jermyn-street—An improvement in the manufacture of paper, or paper pulp.—(Communication.)

2316. William Crossley and Samuel Beaumont, Hulme, Manchester—Improvements in the manufacture of cement.

2317. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of anchors.

2318. Jules H. Clément, Paris—An improved brake for railway carriages, parts of which are applicable to brakes for other purposes.

2319. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of railway bars.

2320. William Thomson, Perth—Improvements in four-wheeled carriages.

2321. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of cast-steel.

2322. Ebenezer Mackinlay, Glasgow—Improvements in reeling apparatus for winding yarn into hanks.

2323. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in metal beams, girders, and tension bars, used in the construction of roofs, floors, and other parts of buildings, and in the construction of viaducts and suspension and other bridges.

2324. William H. Walton, Glasgow—An improved machine for carding, combing, or preparing fibrous substances.

2325. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of ordnance, and in the projectiles to be used therewith.

2326. John J. Halcombe, Magdalen College, Cambridge—Improvements in gates.

2327. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of railway wheels.

2328. Frederick Ayckbourn, 30 Palace New-road, Lambeth—An improved apparatus for brushing and cleaning of boots, shoes, and trousers.

2329. John T. Pitman, 67 Gracechurch-street—An improvement in fire-arms.—(Communication.)

2330. Thomas Taylor, Manchester—Improvements in apparatus for extinguishing fire by means of water, part of which is also applicable to governing the discharge of fluids for other purposes.

2331. John Adcock, Marlborough-road, Dalston—Improved apparatus for measuring and indicating the distance travelled by ships or other vessels.

2332. Thomas R. Harding, Leeds—Improvements in combs, gills, and hackles, used in the preparing and manufacturing of flax, silk, wool, or other fibrous substances, and in combs for combing the human or other hair.

Recorded October 18.

2333. Charles E. Jones, Huddersfield—Certain improvements in machinery for raising water and other liquids by means of a combination of the principle of the accumulation of force, by compression of air or other elastic fluids, and that of centrifugal force, the more readily to obtain increased mechanical power thereby.

2334. John Wakefield, Birmingham—Improvements in machinery used in the manufacture of screw-blanks, nails, pins, rivets, and other similar articles.

2335. William Glass, 2 Dahlia Cottages, Millwall, Poplar—Improvements in obtaining a deodorizing and disinfecting material.

2337. Dr. Graham, Over Darwen, Lancashire—Improvements in the manufacture of paper-hangings, and in machinery to be used in such manufacture.—(Communication.)
2338. John Graham, Aughton, Lancashire—Improved machinery for cleaning and dressing rice and other grain.
2339. John C. Wagstaff, 20 Grosvenor-street—Improvements in the manufacture of seamless garments, and other seamless fabrics.—(Partly a communication.)
2340. John D. M. Stirling, Larches, near Birmingham—Improvements in coating silver, copper, zinc, and iron, and alloys of those metals.

Recorded October 19.

2341. John Smith, 32 Brydges-street, Govent-garden—Improvements in the construction of bedsteads, such improvements being applicable to carriages, ambulances, and other articles.
2344. William Smith, 10 Salisbury-street, Adelphi—Improvements in sewing machines.—(Communication.)
2346. John Elce, Mânchester—Improvements in self-acting mules for spinning cotton and other fibrous materials.
2347. Henry Giller, Southampton-street—An improvement in globes and shades for gas and other lights.
2348. Nathaniel Smith, Thrapston, Northampton—Improvements in mills for reducing grain and other substances.
2349. William Field and Edward Jeffreys, Shrewsbury—Improved means for securing the rails of railways in their chairs or bearings.

Recorded October 20.

2350. Thomas Craven and Matthew Pickles, both of Birstall, Yorkshire—Improvements in weaving.
2351. Pierre A. Massip, Paris, and 4 South-street, Finsbury—Invention of a machine for preparing hat linings.—(Communication.)
2352. Pierre A. H. Parant, Limoges, France—Improvements in manufacturing millstones.
2353. Nathaniel S. Dodge, St. Paul's Churchyard—Improvements in machinery or apparatus for spreading or distributing water-proofing or similar compositions over webs or sheets.—(Communication.)
2354. Thomas Valentine, Daniel Foster, and Giles Haworth, Belfast—Improvements in power-looms.
2355. Frederic Whitaker, Murray-street, New North-road—Improvements in the construction of sewing-machines.
2356. Hypolyte Gaudibert, Paris—An improved construction of guard for preventing surreptitious removal of watches, purses, pocket-books, and other articles from the person.
2357. Henry Woodrow, Wood-street, Cheapside—Improvements in shirts.

Recorded October 22.

2358. William Teall, Wakefield—A mode of treating certain materials containing fatty or oily substances, in order to extract those fatty or oily substances therefrom.
2360. Alexander M'Glashan and Edward Field, both of Coal Yard, Drury-lane—Improvements in printing presses.
2363. Vincent Scully and Bennett J. Heywood, Dublin—Improvements in clips or holders for suspending railway tickets, and other small articles.

Recorded October 23.

2365. William Wilson, Manchester—Certain improvements in machinery for crushing grain and other substances.
2366. Alfred Gregory, 21 Church-street, Christ Church, and John Jillings, 6 Temple-street, Whitefriars—Improvements in cleansing the basin or pan of water-closets, and in apparatus for the same.
2367. Adolphus Oppenheimer, Manchester—Certain improvements in machinery or apparatus for stretching or distending velvets and other piled goods or fabrics, for the purpose of cutting the pile of such goods.
2368. George Collier, William Bailey, and Richard Horsfall, all of Halifax—Improvements in drying wool and other fibrous substances.
2370. Thomas Roberts and John Dale, Manchester—Certain improvements in treating and preparing amylacious substances for the purpose of stiffening.
2371. Thomas Richardson, Newcastle-on-Tyne—Improvements in the manufacture of glass and clay wares.
2372. William Shears, Bankside, Southwark—An improvement in cases or magazines for gunpowder or other explosive preparations or compounds.
2373. Henry Weber, Zurich, Switzerland—Certain improvements in apparatus for motive power.
2374. Alfred V. Newton, 66 Chancery-lane—Improvements in machinery for making rope and cordage.—(Communication.)
2376. John Bevan, Deptford—Improvements in projectiles.

Recorded October 24.

2377. Jacques Rives, Paris—Improvements in looms for weaving.
2378. John Healey, John Foster, and John Lowe, Bolton-le-Moors—Improvements in machinery to be used for drawing, moulding, forming, and forging various articles of metal.
2379. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in lamps.—(Communication from Abraham Coates, New York.)
2380. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the production of dies and matrices, particularly applicable to the production of printing surfaces.—(Communication from M. Beslay.)
2381. John E. Mayall, 224 and 226 Regent-street—Improvements in photography.
2382. Ellis Butterworth, Rochdale—Improvements in machinery or apparatus for preparing, spinning, and doubling cotton, wool, and other fibrous materials.
2383. Charles Crickmay, Lambeth, and Frederic J. Clowes, Camberwell—Improvements in the manufacture of guns, pistols, and gunstocks, and in cutting and carving wood, metals, and minerals, and other materials by machinery.
2384. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and Paris——Improvements in churns.—(Communication.)
2385. Eugène H. Rascal, Catherine-street, Strand—Improvements in apparatus used in the manufacture of type and other articles for letterpress printing.—(Communication.)

Recorded October 25.

2386. Alfred Ardouin, East Greenwich, Kent—Invention of a corking and capsuling machine.
2387. Henry Tritton, Great Grimsby, Lincolnshire—An improved safety apparatus for the protection of persons while painting the exterior of buildings and cleaning windows, which may be used as a balcony for holding flowers.
2388. Edward D. Johnson, Wilmington-square—Improved apparatus for tuning stringed instruments.
2389. James Platt and John Whitehead, Oldham—Improvements in machinery or apparatus for preparing clay for the manufacture of bricks.
2390. Joseph Robinson, Aldersgate-street—Certain improvements in winding clocks.
2391. John A. Richards, 10 Tyers Gateway, Bermondsey-street—Improvements in producing the "hard grain" on leather.

Recorded October 26.

2392. Thomas B. Sharp and Richard Furnival, Manchester—Certain improvements in machinery for drilling, grooving, and slotting.
2393. John Pinches, Oxendon-street, Haymarket—Improvements in the construction of dies or stamps for marking papers, linen, or other substances.
2394. Frederick C. Calvert, Manchester—Improvements in the treatment of copper slags, scoriæ, or cinders, so as to obtain the iron which they contain.
2395. Edwin Pugh, Charham, Kent—Invention of safety alarum and signal apparatus.

Recorded October 27.

2396. Joseph C. Frederick, 3 Sidmouth-street—An improved variation and azimuth compass.
2399. Simon O'Regan, Liverpool—Improvements in marine engine boilers, and other boilers and their furnaces.
2400. John D. M. Stirling, Blackgrange, Clackmannan—Improvements in the manufacture of cast steel tubes and cylinders, applicable especially in the manufacture of cannon, mortars, and other guns, also steam and other cylinders.
2401. John Ashton, Oldham—Improvements in certain parts of machinery, known as "self-actors," employed for spinning and doubling cotton and other fibrous materials, for more effectually crossing the yarn during the shaping or building of the "cops" than heretofore.
2402. George Geyelin, Melville-terrace, Torriano-avenue, Camden-road—An improved construction of perambulator.
2403. Peter C. Wood, Guildford-street East—Improved machinery for preparing or scutching flax, and other analogous fibrous substances.—(Communication.)
2404. Joseph Hands, Duke-street, Grosvenor-square—Improvements in preserving animal and vegetable substances for food.
2405. Edwin Tomlinson, Crayford, Kent, and Alfred M. Job, Islington—Improvements in waterproofing skins of animals.
2406. John J. Speed, jun., Detroit, Michigan, U.S.—Improvements in car and carriage springs.
2407. Alfred Abel, Spring-street, Sussex-gardens, Hyde-park—Improvements in stopping, filling, or plugging teeth, and in instruments to be used therefor.

Recorded October 29.

2408. George Riley, 12 Portland-place North, Clapham-road—An improved roller-mill for grinding malt.
2410. Joseph Whitworth, Manchester—Improvements in artillery and fire-arms.
2412. Léon Roudière, Paris—An improvement in boots for cavalry.
2414. William Hartley, Bury, Lancashire—Improvements in safety-valves.
2416. Peter Armand le Comte de Fontaine-Moreau, 4 South-street, Finsbury, and Paris—Improvements in brakes for railway carriages.—(Communication.)

Recorded October 30.

2418. William C. Holmes, Huddersfield—Improvements in steam-boilers, and in the mode or method of preparing or generating steam, and in the apparatus connected therewith.
2420. Joseph Barrans, Deptford—Improvements in steam-boiler furnaces.
2422. Jules J. B. S. Martin de Lignac, Paris—An improved mode of preserving animal substances.

Recorded October 31.

2424. Robert Griffiths, Manchester—Invention of a compound and exact measurement tap, applicable to the measurement of every kind of liquor or liquid.
2426. Thomas W. Rammell, Trafalgar-square—Improvements in preparing black-lead, chalk, and other materials used for drawing, writing, and marking.
2428. George F. Woolston, Washington, U.S.—Improvements in cutting and planing wood.
2430. Thomas S. Grimwade, Harrow—Improvements in treating milk, in order to preserve it.
2432. Alfred V. Newton, 66 Chancery-lane—Improvements in the manufacture of gas.—(Communication.)

Recorded November 1.

2434. Henry B. Beaumont, 11 Gloucester-terrace, Hyde-park—Improvements in portable dwellings or huts, vehicles, and boxes, or packing materials for travellers.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

DESIGNS FOR ARTICLES OF UTILITY.

Registered from Sept. 27th to Oct 22d.

Sept. 27th,	3762	W. Javal, Broad-street,—" Focus regulator."
Oct. 1st,	3763	J. B. Haden, Warminster,—" Crimean stove."
5th,	3764	Wright, Underwood, & Burt, Bristol and London,—" Wrist supporter."
11th,	3765	J. Stoker, Old-street,—" Pack-saddle."
12th,	3766	W. T. Dalton & Son, Ratcliff,—" Socket-bush for blocks."
13th,	3767	R. Leake & T. Dodd, Wigmore-street,—" Portmanteaus."
—	3768	Crichley, Wright, & Co., Sheffield,—" Lever counterpoise."
17th,	3769	W. Blackford, Camberwell-gate,—" Carriage window-frames."
19th,	3770	Wheeler, Kinder, & Robinson, Leicester,—" Carriage bow-spring."
22d,	3771	A. Stargardter, Mitre-street,—" Self-adjusting galosh."
—	3772	S. Garside, Ashton-under-Lyne,—" Vice-dies for tubes."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered.

Oct. 8th,	700	D. S. Brown, Old Kent-road,—" Ship's inclinator."
—	701	F. Wickstead, Upper St. Martin's-lane,—" Carriage spring brace and iron."
—	702	F. Wickstead, Upper St. Martin's-lane,—" Double cee spring."
9th,	703	W. Blackford, Camberwell-gate,—" Carriage window-frame."
10th,	704	N. Niven, Dublin,—" Water-tight joint."
11th,	705	T. Greaves, Birmingham,—" Button-fastener."
12th,	706	H. Blackford, Long-acre,—" Raising or lowering windows."
13th,	707	D. S. Brown, Old Kent-road,—" Water-gauge."

TO READERS AND CORRESPONDENTS.

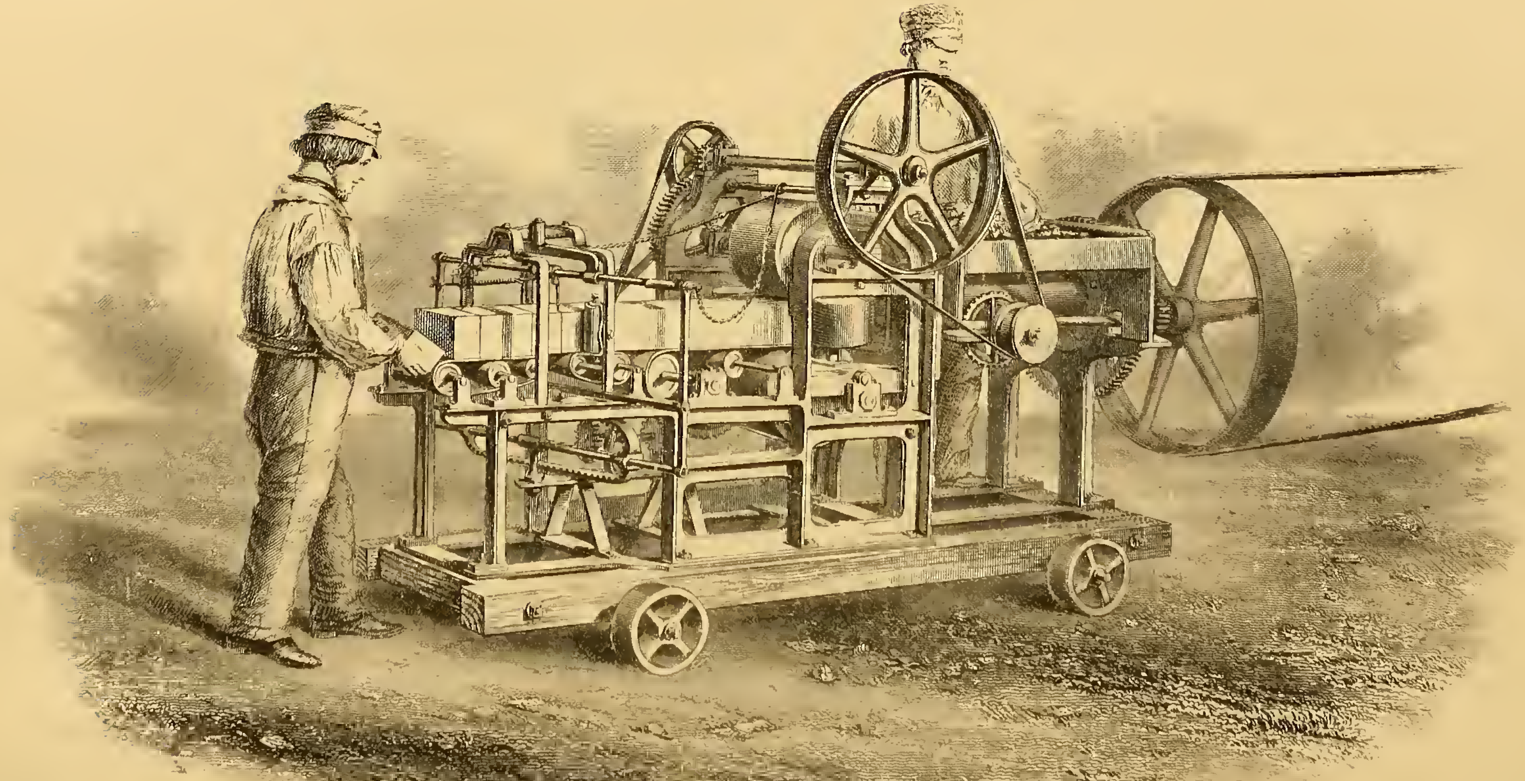
J. G. W.—There is not the slightest similarity between the two contrivances.

J. C.—We are obliged by his long and carefully elaborate favour, but we do not think we can avail ourselves of it for publication.

BRICK TUBE AND TILE MACHINE,

H. CHAMBERLAIN, PATENTEE,

KEMPSEY, WORCESTER.



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47 Lincolns Inn Fields & Glasgow

Mackay Kirkwood

Engraved by F W Phipps
West R^d Sydenham

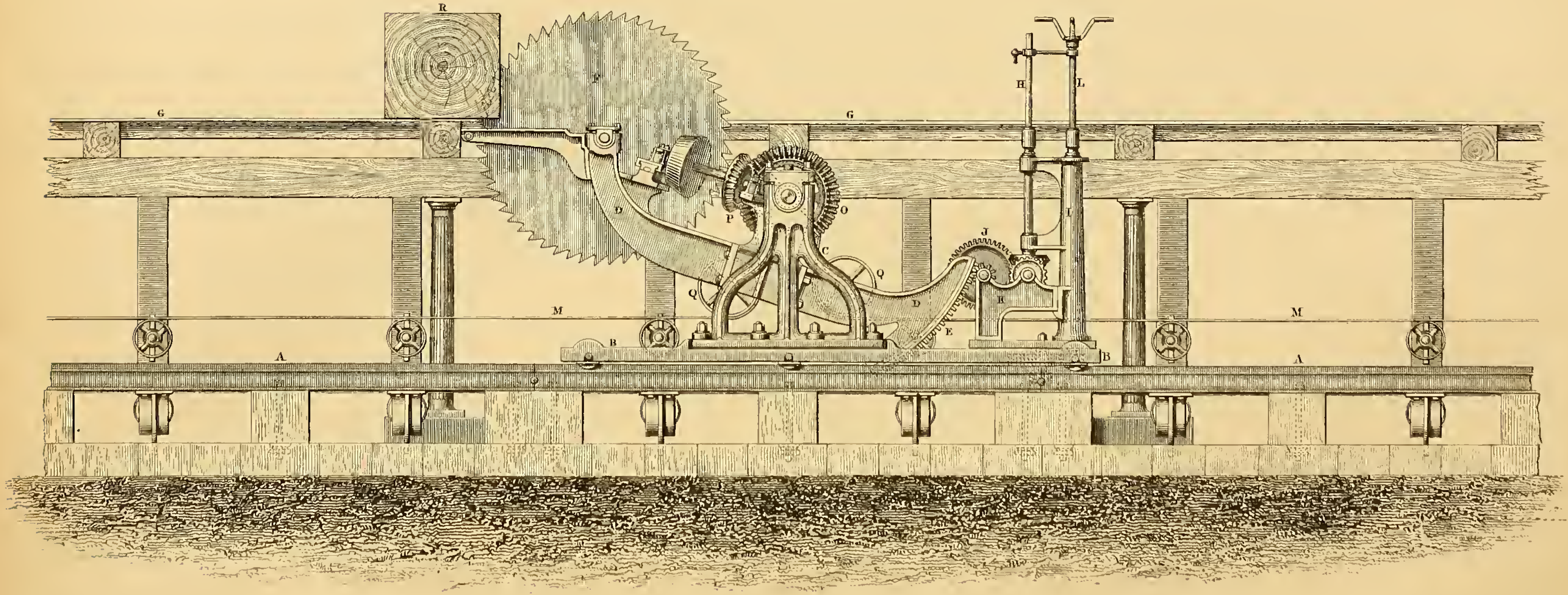
TRAVERSING CROSS-CUT CIRCULAR SAWING MACHINE,

ERECTED AT THE ROYAL ARSENAL, WOOLWICH,

By

JOHN M^c DOWALL & SONS, WALKINSHAW FOUNDRY,

JOHNSTONE.



W. Johnson, Patent Offices.
47 Lincoln's Inn Fields & Glasgow

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SCALE

INCHES 12 6 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 FEET

PROLONGATION OF PATENTS.

By the Authors of the Patentee's Manual.

Notwithstanding the merit and utility of his invention, a patentee sometimes finds himself, nearly at the expiration of the term for which his patent was granted, without having reaped the reward which he was fairly entitled to expect. This may have happened from various causes. To perfect the invention, to work it out, and to bring it before the public, may have been attended with great expenses, which were never repaid. It sometimes occurs that the public are slow to acknowledge the merit of an invention of real value, and the patentee's privilege is on the point of expiring before they can be brought to extend their patronage to it. It may be that the patentee's monopoly has been infringed, and that large costs have been incurred in defending his just rights. Or it may be that the patentee did not himself possess the means, and was never fortunate enough to meet with a capitalist to advance what was necessary to work the invention. From some one of these causes, or from several of them combined, it sometimes occurs that a patentee fails to derive any benefit, even if he escapes loss, from an invention of merit and utility. Previous to the passing of the statute 5 and 6 Wm. IV., c. 83, there was no mode of obtaining the extension of a patent privilege except an Act of Parliament, which was attended with considerable cost. But a much less expensive mode was provided by the fourth section of that act, namely, by petition to the Queen in Council; and her Majesty was empowered, after report from the Judicial Committee, to grant new letters patent, for a term not exceeding seven years after the expiration of the first term. In case the patentee believes that a further term of seven years will not suffice for his reimbursement and remuneration, then he may proceed, under the second section of the 7 and 8 Vict., c. 69, and apply for a longer period of extension, which cannot, however, exceed fourteen years. The benefit of these enactments is extended, by the 4th sect. of 7 and 8 Vict., c. 69, to the assignee of a patentee; and the provisions of these acts, and of the Act 2 and 3 Vict., c. 67 (to be noticed hereafter), are extended to patents granted under the Patent Law Amendment Act, 1852, by the 40th sect. of that act, and the 7th sect. of 15 and 16 Vict., c. 115.

The proceedings commence by the insertion of advertisements in the public prints, giving notice of the patentee's intention to apply for a prolongation of his patent, and a petition, setting forth the facts, must then be presented to her Majesty in Council. Any person is entitled to enter a caveat, and to be heard in opposition when the case is entered upon before the Judicial Committee of the Privy Council.[*] Not more than two barristers will be heard on each side; that is to say, two in support of the applicant's case, and two in opposition. Where, however, more parties than one oppose, and they have separate and independent grounds of opposition, each will be allowed two counsel.

The patentee must be prepared at the hearing with evidence to show that there is an invention; that the invention possesses utility, and is a benefit to the public; and, if his case is that he has never been reimbursed his expenses, he must give reasonable evidence of the amount of his loss. If, however, there is a balance of profit, but to an extent incommensurate with his fair expectations, he will be required to show what the real profit has been. The accounts must be clear, and properly proved. The profit, year by year, must be shown.[†] If the invention has not been brought into use, that circumstance must be explained.[‡]

It is open to those who oppose the patentee's application, to go into evidence for the purpose of showing that the invention is wanting in novelty, or that it is imperfect; and they may likewise point out defects in the specification.

The fact of improvements having been made by other persons in the patentee's invention after the date of his patent, does not afford any ground of opposition to an application for an extension, if the invention has a merit of its own, and if the patentee has not reaped a benefit in proportion to that merit.[*]

Where the ground of opposition to a patentee's application is frivolous, costs have been awarded to him; on the other hand, costs of opposition have been given against a petitioner who abandoned his application.[†]

The 2d section of the 2 and 3 Vict., c. 67, directs that the petition for an extension of letters patent shall be presented at least six calendar months before the expiration of the original term. If the petition shall not have been prosecuted with effect before the expiration of that term, from other causes than the neglect or default of the petitioner, the Committee of the Privy Council is empowered to entertain the application, and to report thereon, although the original term may have expired before the hearing of the application. But sufficient reason must be shown to the satisfaction of the Committee for the omission to prosecute with effect the application before the expiration of the original term. The new letters patent bear date the day after the expiration of the original term. If any one should use the invention in the interval between the expiration of the original term and the grant of the new patent, he is not liable for an infringement. Moreover, those who may have invested capital in working it during that interval may attend before the Committee, and oppose the application, or prefer a claim to have their acts protected, and their expenditure made good.[‡]

If litigation, involving the question of the validity of the patent, should be going on at the time of the application for a prolongation, the Committee will not go into the question, but will assume the patent to be valid, unless the invalidity is patent, and beyond all reasonable doubt, in which case they will not grant an extension.[§] If a competent tribunal should, after the grant of a new patent, decide that the original patent was invalid, the new patent will share its fate, and will be invalid likewise.[‖] So that, in point of fact, the extension decides nothing, one way or other, as to the validity of the patent. And therefore, where it is only a matter of doubt as to the validity of the patent—as, for example, where the evidence is conflicting—the extension will be granted, if there appear good grounds *aliunde* for that course.

The jurisdiction conferred upon the Judicial Committee by the legislature is an extraordinary one, and is to be exercised, as remarked in the Council Chamber, only on the most special grounds alleged and proved in reference to each case. In coming to a decision, they seek to meet the justice of the case with regard to the adequacy or inadequacy of the patentee's remuneration. If he has met with loss, as the total result of his transactions under the patent, there is good *prima facie* ground for an extension; but if a certain amount of profit has been derived from working the patent, a decision is less easily found. The main question, however, remains the same:—Has the patentee been adequately rewarded? It is obvious that the merit of the invention is now an element to be considered, since £100 may very well reward an invention of small utility, whilst £1000 may be an inadequate payment for a discovery of great public benefit. The degree of inventive power may also very well be taken into consideration, and the more or less time and trouble expended by the inventor in making experiments, either previous to his discovery, or in testing it, or in carrying it out. It is not, however, to be assumed, that because the step in improvements taken by an inventor is small, his merit is likewise small, and his invention unimportant. A very small addition or alteration may have altogether escaped notice, until seized and turned to account by an acute mind; and its adoption may lead to most important consequences in the manufacture with which it is connected. The reward of such an invention ought not to be made proportionate to its apparent insignificance. Common justice dictates that the benefit an inventor has conferred on the public ought to be regarded; and the advisers of the Crown, acting under this idea, will give him the opportunity of reaping a recompense in some degree commensurate with the value of the result. In delivering judgment on an application to the Privy Council for an extension of Soame's Patent (W. P. C., 729), Lord Brougham used these words:—"The whole history of science, from the greatest discoveries down to the most unimportant—from the discovery of the system of gravitation itself, and the fractional calculus itself, down to the most trifling step that has ever been made, is one continued illustration of the slow progress by which the human mind makes its advance in discovery. It is hardly perceptible, so little has been made by any one step in advance of the former state of things, because generally you find that just before there was something very nearly the same discovered or invented." His Lordship proceeded to say, that in the case of a new principle or a novel invention—for instance, a new process—the smallness of the step did not furnish any argument against its importance. But when a new application only is under consideration, such an application as might easily suggest itself to any person—a new application of a well-known simple process, which had been employed with respect to other substances—then, when a patentee comes to apply for an extension of his patent, the smallness of the step involved in the patented invention will be taken into consideration in determining the length of the extension. In this case the invention consisted in an application of mechanical pressure to separate the solid and fluid constituents of cocoa-nut oil. The invention having been of moderate benefit to the public, the moderate extension of three years was granted to the patentee.

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[*] Lowe's Patent, 8, Moore's Patent Cases, Case 1.

[†] Perkins' Patent, 2, W. P. C. 6.

[‡] Wright's Patent, 1, W. P. C. 575.—Woodcroft's Patent, 2, W. P. C. 29.

[*] Galloway's Patent, W. P. C. 727.

[†] Mackintosh's Pat., W. P. C. 739.

[‡] Russell *v.* Ledsam, 16, L. J. R. Ex., 145.

[§] Woodcroft's Patent, 2, W. P. C. 30.

[‖] Kay's Patent, 1, W. P. C. 571.

We shall proceed to mention a few cases of applications for extension of letters patent, which will illustrate what has been said. On an application for an extension of a patent granted to James Kay, for improved machinery for preparing and spinning flax, it was shown that the patentee had expended £500 in experiments, £500 in obtaining his patent, £2,200 in law expenses, and that he had made about £6,800 profit. The invention was one of great utility, was used by nearly all the flax-spinners in the kingdom; but looking at the sum already cleared by the patentee, it was thought that a prolongation for three years would satisfy the justice of the case.*

Richard Roberts obtained a patent for improvements in spinning-jennies, the value of which was so great, that during the last three or four years of the original term, £5000 a-year had been made by the patentee. In consequence, however, of piracies, of combinations amongst workpeople, but chiefly of a fire, supposed to have heen the act of an incendiary, which destroyed the patentee's premises, and entailed a loss of £10,000 beyond the insurance, the profits did not reach the amount of loss by several thousand pounds. The Committee of the Privy Council, guided by the ingenuity of the invention, and the peculiar character of the resistance to its introduction, were of opinion that seven years' prolongation was merited.†

L. W. Wright applied for an extension of his patent for improvements in bleaching apparatus, and gave evidence before the Committee of his pecuniary embarrassments, and the disputes which had arisen out of his partnership with various persons; which embarrassments and disputes had prevented the introduction of the invention to the trade. He showed that the invention had been successfully practised by several bleachers, but that he had hitherto derived no benefit whatever from it. The Committee reported that it would be proper to prolong the term for seven years.‡

A patent for a new method of preparing iron plates for tinning was granted in 1839, to Thomas Morgan, who, being unable to work the invention, had sold his patent right for £200 to persons who applied, in conjunction with the patentee, for an extension of the term. The assignees had made a profit of about £1000 a year for three years, and the patentee, in addition to the sum received from them, was making about £2 a week out of the patent. The invention appearing to possess only a moderate degree of merit, the Committee thought that the benefit received by the patentee and his assignees was a sufficient reward, and they refused the application.*

A patent for printing yarns of any fibrous materials was granted in 1828, to Bennet Woodcroft, who, on the expiration of the original term, applied for an extension. The patented process gave to cloth made of yarn printed by it a peculiarly clouded appearance, and the invention gave rise to the manufacture of clouded silks and fabrics. During the first four years of the patent, £7000 were realised under it. Certain duty, however, was taken off other goods, and from this cause and others a large capital invested in working the patent ceased to be profitable, and the patent right became of small value. At a subsequent time the invention, under an improved form, was stated to have become of considerable value, and it was thought proper to apply for an extension of the patent. But the Committee, having regard to the amount of profit already realised, and to the fact that the invention, in its improved and valuable form, was introduced from abroad by other persons than the patentee, refused the application.

In 1840, Orlando Jones obtained a patent for improvements in the manufacture of starch. His method consisted in applying a weak solution of caustic alkali to rice. It was shown, at the hearing of an application for an extension of the patent, that the principle of the invention had been discovered by another person prior to the date of Jones' patent, although Jones was not aware of the fact. The invention being thus shown to have no novelty, the application was refused, and costs to the amount of £100 were decreed against the petitioner.

On the application for an extension of Derosnes' patent, for improvements in refining sugar, it appeared that the patentee's net profit had been about £3300. But the benefit to the public was so great, being appreciable in every pound of sugar consumed, that an extension of six years was granted.†

G. F. Muntz applied for an extension of his patent, for improvements in the manufacture of sheathing for ship bottoms, and showed that he had made £55,000 by the manufacture during the existence of the patent. The applicant contended that this sum did not represent his profit as an inventor and patentee, but his profit as a manufacturer. But the Committee of the Privy Council said it was impossible to sever these two heads of profit. It was by means of the patent that he had made the profit. It had given him a monopoly preference; because, as patentee, he was enabled to sell and to trade in a manner which, but for his invention and his patent, he could not have done. The application for a prolongation of the patent was refused.‡

A. M. Perkins obtained a patent in 1831, for improvements in an apparatus for heating air in buildings, heating fluids, &c. He applied, in 1845, for an extension of the patent, on the ground that he had been inadequately rewarded. The ingenuity of the invention, and its application to a great number of purposes, having been shown, the accounts were investigated, when it appeared that there had been a profit of £15,176 upon gross receipts to the amount of £64,920. The patentee claimed further to reduce the sum representing his profits, by deducting £500, the cost of experiment, £2700 interest at five per cent. on the average amount of capital employed, and £5400 for an allowance of £400 a year to the patentee for his personal superintendence of the business. These sums reduced the profits to £6576 net. An extension of five years was granted, the invention being ingenious and useful.§

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* Kay's Patent, W. P. C. 568.
† Roberts' Patent, W. P. C. 573.
‡ Wright's Patent, W. P. C. 575.

* Morgan's Patent, W. P. C. 737.
† Derosne's Patent, 2 W. P. C. 1.
‡ Muntz's Patent, 2 W. P. C. 113.
§ 2 W. P. C. 7.

An application for the extension of a patent for improvements in the manufacture of steel, was opposed on the ground that, whereas the patented process consisted in the addition of carburet of manganese to the crucible, it had been subsequently discovered that a better process of making steel was to place carbonaceous matter and manganese separately in the crucible, and this process obtained generally in practice. The Privy Council thought that the merit of the original invention was not thereby materially detracted from, and they granted an extension for seven years. In granting so long a time, the litigation going on in the courts of law was taken into account, as it was thought probable that some time would elapse before the litigation would terminate, and the patentee's representatives have the benefit of the extension granted.[*]

An application was lately made for an extension of Foard's patent, for a smoke-consuming furnace. Evidence was adduced to show that the apparatus was cheap in its construction and economical in its operation, the saving of fuel being estimated from 15 to 20 per cent. The persons interested in the patent had sustained a loss of £1200. On the part of the Attorney-General (who is entitled to attend the hearing of every application for the extension of patents, and to watch the proceedings on behalf of the public), it was suggested, that, as an act would probably soon be passed to compel the consumption of smoke in all manufactories throughout the kingdom, to grant an extension of the patent for the whole time prayed for, viz., fourteen years, might impose a heavy burden on the public. The Committee granted an extension for six years.[†]

A patent for softening and purifying water for domestic and manufacturing purposes was obtained in 1841, and an application was made in 1855 for an extension. Testimony as to the efficiency of the process, and as to its utility to the public, was given. The process had only been employed at the works of one water company; but there was reason for supposing that, as new companies were established, they would all adopt it. The patentee had expended £1000 in endeavouring to bring his invention into general use, but hitherto without success. The report recommended an extension for seven years.[‡]

Whitehouse, an ingenious mechanic, procured a patent for improvements in the manufacture of iron tubes, which he assigned to his master, Russell, who laid out £14,000 in works to carry out the manufacture. The tubes were in great demand, being applicable to a variety of new purposes; but, as the manufacture was simple, many expedients were resorted to to evade the patent, and Mr. Russell was involved in much litigation, in consequence of which, combined with the loss incurred by surreptitious manufacture and sale, very considerably reduced his profits. On these grounds he applied for a prolongation of the patent, and produced evidence before the Committee to show the value and importance of the invention, the losses he had suffered from infringements, and the great reduction that would take place in the value of the premises and machinery (much of which was fitted only for the particular manufacture) if the patent were thrown open. He further showed that his life had been endangered by the anxiety of certain law proceedings. One witness stated that, if the manufacture were thrown open, it would hardly be worth following; the process was so beautifully simple, that it would almost be in the reach of any person of capital. The net profits amounted to about £13,000; but this was shown to be not much greater than the ordinary profits on stock without the protection of a patent. Taking all this into consideration, seeing that the invention was of extraordinary merit, and that Mr. Russell had suffered greatly from the annoyance and anxiety occasioned by the litigation to which he had been subjected, the Committee thought the patent ought to be extended for six years, the original patentee receiving £500 a year out of the profits for that time.[§]

A patent for forging and shaping small articles in metal was obtained by Mr. Ryder in 1841, and he lately applied for an extension, pleading that though the profits had been £7000, they had only been made during the last four years. This, however, was held to be no ground for the application in the face of the large sum realised, and the petition was dismissed.[*]

It will have been remarked that the maximum period of extension in these cases was seven years. To induce the Judicial Committee to recommend an extension for fourteen years, a case of the strongest kind must be made out.

Where the invention is one of great merit, and the patentee has assigned his interest in it to another person for what, looking at the profits likely to be derived from working the invention, appears an inadequate consideration, the Privy Council, in recommending an extension to the assignee, will see that the patentee receives a farther reward. With this view, a condition is sometimes introduced into the new patent, making it void in case a fixed annual sum, or a certain share in the profits, be not paid to the patentee by the assignee.[†]

Other special conditions are sometimes inserted in the new letters patent; for example, that the patented article should be sold to the public at a certain price[‡]—that the Admiralty should have the privilege of using the invention (in this case, an improved propeller for steam and other vessels,) without licences from the patentee.[§]

HIGH-SPEED ENGINES FOR SCREW PROPULSION.

By Messrs. Blackwood & Gordon, *Engineers, Paisley.*

The chief advantages to be expected from the rotatory steam-engine, so long unsuccessfully sought for, would arise from the continuous motion in one direction of the moving parts. The reciprocation of heavy weights, as in the common engine, is injurious in accelerating wear, and in preventing the attainment of a high speed, if, indeed, it does not involve a misapplication or loss of power. Messrs. Blackwood & Gordon have endeavoured to solve the problem, by arranging the elements of a common reciprocating engine in such a way, as to obtain the continuous rotation in one direction of all the moving parts of the engine, thus securing all the advantages of a rotatory movement, without the defects hitherto inseparable from rotatory engines. One modification of the engines constructed on the improved system, is represented in the accompanying engravings; fig. 1 being an end elevation, and fig. 2 a side elevation, partly in vertical section. Three steam cylinders, A, are used, these cylinders being precisely like those employed in ordinary reciprocating steam-engines; that is to say, they are each furnished with pistons, ports, slide valves, and valve casings, with the usual inlet and exhaust passages for the steam. These cylinders are fixed to, or carried by, a disc or frame, B, which is fixed upon the main shaft, C, of the engine; this shaft being, for example, that upon which the screw propeller is fixed, if the engine is used for screw propulsion. The cylinders are placed equidistantly round the disc, with their axial lines radiating from the centre of the disc, and the inlet and exhaust passages for the steam are severally made to communicate with passages in the disc, running to the main shaft, and extending a short distance along this shaft, to two stuffing-box connecting pieces, D, one fixed upon the steam pipe from the boiler, and communicating, by means of lateral apertures in the main shaft, with the several internal inlet passages leading to the cylinder valve casings, whilst the other connecting piece is fixed on the exhaust pipe leading to the condenser or to the atmosphere, accordingly as the engine is of the condensing or non-condensing class, and communicating, by another set of lateral apertures in the main shaft, with the several internal exhaust passages leading from the cylinder valve casings. The steam piston rods may be of the ordinary solid kind, but it is preferred to have them of the trunk class, the trunks, E, passing through stuffing-boxes at the inner end of each cylinder. The several connecting rods issuing from the inner ends of the cylinders, are jointed upon a fixed or stationary abutment pin, F, carried on a fixed standard, G, about which they are capable of revolving; and this pin is placed eccentrically to the axis of the main shaft, to an extent equal to half the stroke of the cylinders. The action of the engine will be obvious, when it is considered that if the cylinders were stationary, and the pin to which the pistons are connected capable of revolving about an axis coincident with that of the frame carrying the cylinders, the steam acting in the cylinders would force round the pin, just as the crank pin of an ordinary engine is forced round: this pin, however, being stationary or fixed in the present engine, the motive agency takes effect upon the moveable frame and shaft carrying the steam cylinders. The valves are worked by means of an eccentric, H, upon the fixed abutment pin, each valve rod being jointed directly to a separate ring loose upon the eccentric; or, instead of this arrangement, the several valve rods may be connected by links to a single ring loose upon the eccentric. The eccentric for working the valves is made adjustable upon the abutment pin by means of a lever, I, or other convenient hand gear, affording a simple and easily workable means of commanding the action of the engine, as, by shifting the eccentric, the engine can be either speedily reversed, made to work expansively to any extent, or stopped, as circumstances may require. This description of engine is capable of being worked with safety at a very high velocity, as the parts of which it is composed have no absolute reciprocating motion; that is to say, the engine is entirely free from the reciprocation of heavy masses of metal, which, in ordinary engines, makes it injurious or impracticable to work them at high velocities. In the arrangement forming the subject of the present invention, the cylinders revolve about a centre; thus, at the same time, working the engine and acting as its fly-wheel. The pistons and valves also revolve about their respective centres, and although the pistons are alternately at opposite ends of their respective cylinders, this apparent or relative reciprocation is merely the result of the non-coincidence of the centres about which they revolve. The several details of the arrangement may be variously modified. Thus, for example, the steam cylinders may be made to oscillate upon the frame which carries them; in which case their piston rods may be jointed directly upon the abutment pin. Or, the abutment pin may be made of comparatively large diameter, the several piston rods being jointed directly to separate rings upon it; the cylinders being fixed upon the revolving frame. According to another modification, the steam cylinders may be carried by the abutment pin—the pistons being connected to the revolving frame—the valves being in this case worked by an eccentric upon the revolving frame or main shaft.

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[*] Heath's Patent, 2, W. P. C. 257.
[†] Practical Mechanic's Journal, vii. 261.
[‡] Clark's Patent.—Practical Mechanic's Journal, vii. 255.
[§] Whitehouse's Patent, W. P. C. 473.

[*] Ryder's Patent.—Practical Mechanic's Journal, vii. 238.
[†] Whitehouse's Patent, W. P. C. 473.—Hardy's Patent, 6, Moore, P. C. 441.
[‡] Hardy's Patent, 6, Moore, P. C. 441.
[§] P. Smith's Patent, 7, Moore, P. C. 133.

Fig. 1.

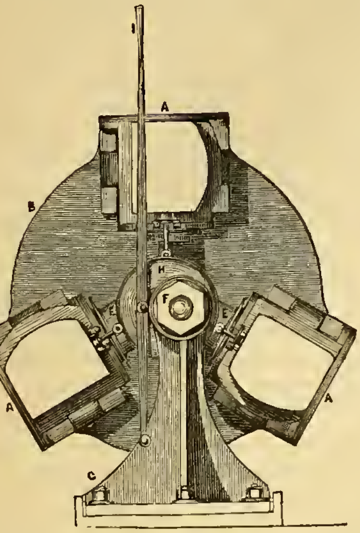
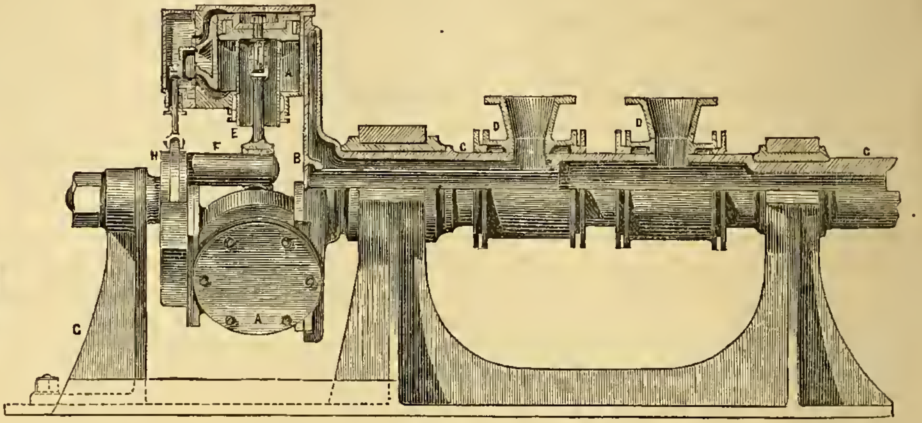


Fig. 2.



BRICK, TUBE, AND TILE MACHINE.

By Mr. Humphrey Chamberlain, *Kempsey, Worcester.*

(*Illustrated by Plate* 183.)

A mechanical brick-maker, which, with the expenditure of four horses' power, and the attendance of three stout lads, will turn out 20,000 moulded bricks per day, deserves our examination. We can, therefore, have little hesitation in devoting one of our plates of the month to the illustration of a contrivance, by which this duty is most satisfactorily performed. This machine, the invention of Mr. H. Chamberlain, M. Inst., Mech. Eng., Kempsey, Worcester, consists of a horizontal pug mill, into which the raw clay is fed, and by which the plastic material is forced through a mouth-piece, or brick die, the exuding stream of clay being seized by four rollers, combined so as to form the clay into a rectangular block. This rectangular stream is passed forward to a vertical-action wire-cutting apparatus, which severs the clay into the proper brick lengths. The human attendants for this action consist of a man or boy, to feed the clay into the pug-mill, and two lads to remove the moulded bricks, which are stiff enough to bear walling up six high at once. The stiffer the clay the better is the manufactured article, as no water whatever is applied to the clay during its passage through the machine.

Our engraving, Plate 182, is a perspective view of the machine, with its attendants and all accessory details, as in full work, making ordinary bricks. The framing is of the open, rectangular, standard kind, at one end of which is the horizontal pug-mill and feed aperture. The action of the screw-blades of this mill gradually propels the clay forward in a continuous stream, until the opposite moulding end is reached. This aperture is oblong, resembling the sectional shape of a brick, but having its corners, or edges, well rounded off, it being a well-understood fact, that a mass of clay, presenting a sectional area of 50 inches, cannot be expressed through an opening with sharp corners to produce good edges, as the angles produce so much more friction than any other part of the thoroughfare. Hence it has been the practice with this class of machinery to insert a centre-piece in the die opening, and make hollow or perforated bricks. In thus making cellular bricks, the tongue-pieces cause sufficient resistance in the centre of the die, to compel the clay to get well into the angles, and thus in some measure meet the experienced difficulty. But, on the other hand, the gain here is balanced by the additional expense required in the preparation of the clay, as, if the latter is not of the finest quality, it will not pass the sharp corners with anything like the necessary smoothness. Mr. Chamberlain rises above his difficulties here by rounding off the die corners, and delivering the stream of clay into the hands of a set of four smooth rollers, covered with a porous fabric. These rollers are of course in pairs, one pair horizontal, and the other vertical. Their office is to compress the clay into a mass of oblong section, the size and shape of a brick set on edge, and having beautifully sharp corners. As quickly as it is thus shaped, the clay is received upon an endless-carrying web to the self-acting wire-cutting frame at the other end of the machine. This wire action is put in motion by being geared with the four die rollers, the rollers themselves being driven by a belt from the pug-mill gearing. If the die rollers have even the slightest motion given to them from the pug-mill action, the wire is put in action, and made to traverse at an angle in the direction of the clay stream, so as to insure an accurately square cut whilst in motion. So soon as one brick has been severed, the wire changes its action, and cuts off the succeeding brick at the reverse angle. The severed bricks then pass on to the extremity of the frame, and they are then received by the attending boys on pallet boards.

All the driving belts of the machine have a strip of leather sewn along the outer edge of the inside. This clips the end of the rollers, and prevents their working off. Should the feeder neglect his work, the small pulley on the side which drives the moulding details slips in its strap, not being sufficiently large to draw away the clay from the mouth-piece; but directly the clay begins to escape, the whole machine recovers its functions. And should the clay cease to come, from the man neglecting to feed, all that part of the machine beyond the pug-mill immediately stands still. With a machine of this class, the actual production depends upon the activity of the lads in removing the moulded bricks. Three good hands can take off 2000 per hour.

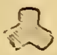
This machine was shown to the public for the first time on the 6th of September last, at the Liverpool and Manchester Agricultural Society's meeting at St. Helen's, when it was awarded a Silver Medal; and at the Staffordshire Agricultural Society's Show, at Leek, on the 27th of September, when it again carried off a Prize and Silver Medal. It was also exhibited at the Worcester Agricultural Show on the 5th of October, but not being an agricultural implement, the judges could not award it a prize, but they recommended it a bounty of £2, as a clever invention.

THE GREAT EXHIBITION AT PARIS, 1855.

FROM OUR OWN CORRESPONDENT.

V.

From the French machinery space, we pass into that of Belgium, containing a small collection of machinery, but not without one or two objects of interest. The first thing we notice is an elaborately finished model of the safety mine shaft apparatus used at Mariemont. Near this is a model of a triple-edged road rail. This rail is shown in section in the annexed figure. The object of giving the rail this shape, is to render it capable of being worn on its three edges in succession, so as to last three times as long as a rail with a single wearing edge. The objection of the worn edges not fitting into the chairs will apply to this rail, as was found to be the case with the common I rail, which was originally intended to he turned when worn on one edge. A monster mine-ventilating apparatus at work here, has attracted some attention. It consists of two paddles geared together, and with their radial boards dovetailing or working into each other like Murdoch's rotatory engine, and forcing the air down on the outer sides through suitable casings. The apparatus is worked by a single cylinder, connecting-rods to each paddle crank being jointed to opposite ends of a cross-head upon the piston-rod, like Cartwright's engine. At rest, near the ventilator, is a pair of engines with oscillating cylinders working downwards with the shaft below them. Next come—a velvet finishing machine; a set of sugar pans from Cail's Brussels establishment; a blowing engine by the same; a typographic composing and distributing machine; and three locomotives. One of these, with inside cylinders and valve gearing, is by Zamon Sabatier & Co. of Brussels; another, the *Duc de Brabant*, a large tank or compound locomotive on Engerth's system, is from J. Cockerill & Co.'s Seraing Works; the third is one of the common kind from the St. Leonard Company, Liege. In our onward course are, a cotton-beater by Laoureux of Verviers; a wool-carding engine, by Fairon of Verviers; a turning and screwing lathe, by Staadt of Brussels; a continuous wool-carding engine, by Honget & Teston of Verviers, marked sold; and the stern frame of a large iron screw steamer, with oval-eyed rudder for an overhung screw on Beattie's system—a fine piece of forged work—by J. Cockerill & Co. This exhausts our notes of the Belgian machinery.



A collection of Austrian machinery comes next, and covers about as much space as is occupied by Belgium. The first object here is a tank locomotive, suited for passing sharp curves, by Günther of Vienna. A combined central buffer and draw-hook arrangement is shown at the back of this locomotive. Schmid, of Vienna, has here a beam engine in motion, and a horizontal cylinder engine at rest. At the north side near the last is a gaudy family carriage, a black and silver body, with red and white wheels. Near this are some neater vehicles of less pretension. Next come a sugar apparatus, by Lieber of Brünn; Sigl's steam lithographic press from Vienna, the impression roller of which is compounded of a ring of small steel rollers; and the *Wien-Raab* locomotive. This locomotive has eight coupled wheels, the tender having six; the cylinders and gearing are external, and placed very low down. The wheel springs are spiral, and the chimney is of the conical enlarged kind used where wood is burned. Near this locomotive is an apparatus extremely like Strong's,* and apparently intended for a similar use. At the side of this part of the building are some extremely beautiful models of weighing apparatus by Schmid of Vienna, already mentioned, one machine for weighing locomotives, having a model locomotive upon it. Sigl of Vienna shows here some shaft bearings, with oil spaces, and a collar on the shaft in the longitudinal centre of the bearing. Another locomotive on Engerth's system comes next, the drivers of it being geared together like those of the *Bavaria*.† Then we have some spinning, weaving, and carding machinery, by Braccgirdle & Son of Brünn; a Jacquard loom, by Schramm of Vienna; and some silk throwing and winding machines, one of which, by Padernello of Sacile, is extremely well made, and attracted many to watch its beautiful motions. At this, the west end of the Austrian space, is a locomotive from Hanover, upon six wheels, four of which are coupled, and in other details resembling some common English goods engines.

We next enter the Prussian space, and are struck with the large proportion of locomotives contained in it. The first of these, the *Paris*, by Borsig of Berlin, is on six wheels, the central pair being the drivers. The cylinders are outside, and the valves and gearing are inside the framing. A high-speed passenger engine from Carlsruhe is on Crampton's system, with bogie leaders, outside cylinders, and valve eccentrics between the wheels and crank pins, making the latter considerably overhung. The two next locomotives are from the kingdom of Wurtemberg, although placed here in the Prussian space—one of them is on Crampton's system, with valve gearing inside the cranks. The other, the *Esslingen*, is on Engerth's system, with the engine and tender combined, the two being carried upon ten wheels. The three front pairs of wheels are coupled, the centre pair being driven by outside cylinders placed low down; the valve eccentrics are placed outside the cranks. We have mentioned Engerth's system of construction as being exemplified by a great many of the Continental locomotives in the Exhibition, and we may now give a few of the more prominent features of it. The framing of the tender is put together upon the locomotive, and its front portion is made to embrace the fire-box of the latter. The tender framing is jointed to the locomotive framing by a vertical pin, a short distance in front of the fire-box. The foot-plate behind the fire-box is curved to a radius from the joint pin, the adjacent edge of the tender floor being correspondingly curved. The engine and tender are thus enabled to hinge or yield to curves in the line, sufficient play being left between the sides of the fire-box and the tender framing. The tender framing is supported on two pairs of wheels, one pair of which is in front of the fire-box. The boilers of these engines are mostly very long, and the tubes comparatively large. Great efforts are made to get the weights low down; the cylinders are but a few inches above the rails, and the driving wheels are only about four feet in diameter. The minor details are arranged in different ways, as we have pointed out when alluding to the various examples of engines on this system in the Exhibition.

Near the Wurtemberg locomotives is Meggenhoffer's spring balance for safety valves, the novelty in which consists in an arrangement of levers and links, contrived to give a large opening to the valve aperture when the pressure is but slightly above the opening point. Amongst the various objects in the Prussian space are—Schœffer's indicators, from Magdebourg; a model of a cast-iron gun, with wrought-iron lining; some beautiful specimens of wire-cloth for paper machines; an inverted cylinder stationary engine, by Neuman & Esser of Aix-la-Chapelle; a massive-looking steam hammer, by Egells of Berlin, with the piston-rod 8 inches in diameter, and with a very short stroke—being probably on the impulsive system; a piston with four packing rings, by the same maker; a 3 H.P. stationary engine, by Hofmann of Breslau, with rotating valves; lathes and planing machines, by Haman of Berlin, and by Marx of Halle-sur-Saale; and slotting and screwing machines, by Sigl of Berlin. At this part is a fire-engine, by Beduwé of Aix-la-Chapelle, which appeared to be constructed upon a very simple and effective system. A single pump barrel is placed horizontally, and is worked by the usual hand levers through a bell-crank movement. The pump is double-acting, the inlet valves being beneath, and the discharge valves upon the top of the barrel, the discharge valves opening into an air vessel, from which the discharge pipe rises. We may next mention a set of beautiful machines for the manufacture of woollen cloth; an extraordinary engine, by Martini, the piston of which is 12 inches in diameter, the crank $1\frac{1}{2}$ inches radius, and connected to the piston through two levers, which multiply the stroke ten times, so that the actual stroke of the piston is about one-third of an inch; a steam-driven sawing machine, by Schwartzkoss of Berlin, with a rack-feeding motion, holding on to the timber by weighted levers; and lathes, a slotting machine, and a soap press, by Fulda of Berlin. Next come a few things from Saxe Royale—such as spinning and weaving machinery, by Hartmann of Chemnitz; a machine for sawing and polishing stone, by Mannhardt; and a beautiful machine, by Gessner of Schneeberg, for teazling woollen cloths, in which is a breadthener, consisting of a series of pulleys with grooved rims, set upon oblique spindles, and with the pulleys gradually more and more inclined towards the sides, on the principle of an increasing pitch—each individual pulley taking a separate independent hold of the cloth. Finding ourselves again amongst Prussian contributions, we notice—a wool-spinning frame, and a velvet-cutting machine, by Verken of Aix-la-Chapelle; a machine for engraving copper rollers; calender rollers; lathes; machines for producing a smooth surface on paper by means of polished steel rollers and plates; paper-cutting machines of several sizes, with simple lateral screw motion—very superior to machines for a similar use which have lately appeared in England; embossing machines; and printing presses, with double toggle and horizontal lever movement. The whole of these machines for the stationer's use, are from the same workshop, and are exceedingly well made and highly finished.

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* Page 128, Vol. VIII., Practical Mechanic's Journal.

† Page 239, Vol. V., Practical Mechanic's Journal.

Leaving the Prussian machinery space, we next enter the space occupied by machines from Great Britain and Canada. It is the universal remark that Great Britain has not made the show of machinery that she might have done. Several reasons have been suggested as explaining this. Thus it is said that the more important marine-engine makers are too busy with government orders. One explanation which we have not heard mentioned, but which we think is a very likely one, is, that those firms who have been long well established, and can afford the expense of sending machinery to Paris, have nothing new to send, and do not think it worth their while. It is chiefly amongst the younger and rising firms that novel and improved designs and arrangements of mechanism make their appearance, for they have to make their business, and to succeed they must offer such inducements to customers as are not to be met with amongst those old firms who have got into a regular unalterable system of construction. If the older firms think the expense of sending their productions to the Exhibition is not repaid by the advantages obtained, it is not to be expected that the younger firms can spare time and money for such a purpose, when these are so much needed in the up-hill labour of establishing themselves. We cannot but think that this is, to a considerable extent, the case, when we call to mind the numerous important and valuable improvements in all the branches of applied mechanics which have made their appearance in Great Britain since 1851. It may be a surprise to some of our readers to learn, that long-established firms would rather be without any improvements in mechanical construction; but we have been told, by one of the first firms in the kingdom, that it is not to their interest to encourage new inventions. They would prefer continuing to make engines according to their old rules, it being easier to copy what has been done before than to try new plans, and that, as long as they are paid for their work, the less trouble they have with it the better. We need scarcely remark, that these men are not of the James Watt stamp.

On entering the English machinery space, we seem almost to breathe a different atmosphere, everything is so well and neatly arranged, and in such beautiful order. The English officials have all along been much in advance of those of other countries. There was even a considerable contrast in this respect between the English and Prussian departments, the latter being second only to the former. The English machinery space was distinguishable from a distance, by the number of white and red banners placed aloft, and lettered to indicate the classes of the pieces of the machinery beneath. We generally found this to be the most crowded part of the Annexe, and we had frequently great difficulty in obtaining a sufficiently close view of various objects. The first thing we observed was the power-loom for weaving sailcloths and other heavy fabrics, by Messrs. Charles Parker & Sons of Dundee, to whom a medal of honour has been awarded. Next are—Seyrig's centrifugal sugar apparatus, driven by a small horizontal cylinder engine of its own; Gray's spherical engine, on the Cambrian principle; an embroidering machine, by Houldsworth & Co. of Manchester, who have a first-class medal; Chadwick's silk-reeling machine, for obtaining milled silk direct from the cocoon; Smith's Jacquard power-loom; Todd's power-loom for cotton goods; Hart's power-loom for ribbons; Wood's loom for Brussels and pile carpets, the pile being cut by the needles, and the take-up movement being effected by a roller covered with wire-card filleting; and Hodgson's power-loom for twilled goods. T. Walker of Birmingham has here a rotatory engine, and a calorifere or heating apparatus, for the latter of which he has received a second-class medal. When we saw them, these things were lying unarranged upon the ground, and there being no one looking after them, we could not ascertain what points of novelty or improvement they possessed. Matters seem to have been in a better state, however, when the juries made their rounds. This forms one amongst the few exceptions to the general neatness and order in the English department. A companion to this case is that of Bishopp's disc engine, exhibited by Rennie & Co., but lying, when we saw it, apparently just as it had been turned out of its packing-case. Against the southern wall here, is a trophy, by Burch of Crag Hall, Macclesfield, of printed carpets. He also shows a drawing of a printing machine for shawls and carpets, for which a first-class medal has been awarded to him. The honour, however, in this case does not belong to Mr. Burch, as the arrangement shown is Mr. Melville's of Roebank Works, near Beith, Scotland, the drawing being in fact executed from Mr. Melville's specification, by Messrs. W. and J. H. Johnson of Glasgow. Mr. Burch also shows models of his screw steamers. Near this trophy is Fairbairn's stationary engine, which works a secondary first-motion shaft for driving some of the machinery. This is a fine substantial engine, with two vertical cylinders placed within columns carrying the plummer blocks of the main shaft, which has upon it a large toothed driving wheel, acting also as a fly-wheel. At the side, near Fairbairn's engine, is Loysel's coffee-making apparatus, or hydrostatic percolator, a confused mass of polished copper vessels and pipes, which are somehow made to produce a very excellent cup of coffee, as numerous visitors ascertained experimentally. A series of common road carriages and vehicles are ranged along a portion of the north side of the English space. Amongst these we notice some fine examples from Peters & Son of London, who have received a first-class medal; cottage dog-carts and phaetons from Starey of Nottingham, who has also received a first-class medal; and carriages from Hooper & Co. of London, together with some beautiful photographs of carriages by the same firm. Turning from the carriages towards the central space, we observe some pretty machines for making wire-card filleting—one by Foxwell of Manchester, and two by Crabtree of Halifax, who have both received first-class medals; wool-spinning machinery, and cotton carding, combing, and spinning machines, by Mason of Rochdale; and a splendid and complete series of machines for preparing and spinning cotton, by Platt, Brothers, & Co. of Oldham, who have deservedly been awarded a large medal of honour. Messrs. Platt's machines all carry tickets, explanatory of the several processes which they work out, the machines being all in actual operation. To the south side of these last are Kent's knife-cleaning machines, and near them Siemens' regenerative steam-engine. When we saw this engine it was just able to move itself, and no more. This engine is evidently the result of laborious study and perseverance, which we fear it will not repay. It seems to us to be simply a complicated mode of obtaining the duty due to a high degree of expansion. The inventor, however, has been encouraged by the award of a first-class medal. Passing on, we come to some gas-meters, by West & Gregson, and by Paddon & Ford, the latter of whom have obtained honourable mention; some good specimens of needle-point tow-cards, by Robson & Co. of York; and spindles and flyers, by Hattersley of Leeds. Next follow a series of small models and similar objects—a model of Botham's screw engines; one of D. Y. Stewart's moulding apparatus; one of Allen's marine steam-engine, and also his screw propeller, the latter similar to Griffiths' screw, but having a conical boss, according to a plan suggested in this *Journal* about two years ago; a model of a steam-engine by Newton & Fuller; a set of models, by Schiele of Oldham, mostly illustrative of his antifriction curve; a small model of Holm's screw-propeller—a common screw with a turned-over flange on the outer and back edges; a model of a locomotive, by Downing of Dublin; porcelain shuttle eyes and other porcelain details used in manufacturing machinery, by Watkins of Bradford; mule and throstle spindles, by Booth of Preston; specimens of wire-cards for spinning, by Horsfall of Manchester, rewarded with a first-class medal; a soda-water machine, by Tylor of London; apparatus for casting and finishing printing type, by J. R. Johnson of London; Clifford's ship's-boat disengaging apparatus, in which a single central winch lets go both suspensory ropes simultaneously; coin weighing machine, from the Royal Mint, London; Lambert's water-guage for steam boilers; and taps and cocks for water under pressure, by Davis of Southampton. Turning from this collection of things at rest, towards the central space again, we examine the extensive set of cotton preparing and spinning machinery, by Elce & Co. of Manchester, who have received a first-class medal. These machines are in operation, and occupy a large space. Passing round them to the north side, we come upon a collection of models and specimens of the elements of the permanent way of railways, sent by May's Permanent Way Company. There are also some permanent way models and specimens by Seaton of London. There are three locomotives exhibited in the English department—one by Crampton; one by R. Stephenson, the *Emperor*; and one by Fairbairn, the *Eugenie.* Mr. Crampton was one of the Jury, or he would probably have received a medal, as his system is held in high estimation on the Continent. Of the other two engines, Mr. Fairbairn's has carried off the prize—a first-class medal. The *Eugenie* is one of the London and North-Western express locomotives, constructed on Mr. J. E. M'Connell's patented system, and we may save ourselves the trouble of describing this fine engine here, by referring to the complete set of plates and descriptions already published in this *Journal.** In the central space near here are—Cripps' engraving machine for calico-printing rollers; Birch's double-action sash-bar and moulding-cutting machine, at rest; Lloyd's noiseless disc fan-blowing machine, in operation; Neale's steam copper-

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* Page 193, Vol. V., and pages 180 and 201, Vol. VI.

plate printing machine; Donkin's rag and rope cutting machine for paper-makers; Williams' pendulous cylinder stationary engine, in motion; and De Bergue's pumps and propellers. This propeller consists of a long flat float, which is inside a rectangular passage or box, open at each end, and is made to reciprocate by a crank, which causes the float at the same time to be inclined in different directions on the up and down strokes, so that the action on the water is always in one direction as long as the crank revolves the same way. We don't think this propeller will supersede either the paddle or the screw. The power of marine propellers depends principally on the reaction through the propeller on the vessel, and in Mr. De Bergue's system this reaction takes effect in too indirect a manner. Mr. De Bergue also exhibits a moulding apparatus, which appears to be very similar to M'Laren's patented system. Near here is Appold's monster centrifugal pump, exhibited by Easton & Amos, to whom a first-class medal has been awarded. Those who visited the Great Exhibition of 1851, will not require a description of this pump. It is driven by a small high-speed engine, by Barrett, Exall, & Andrewes of Reading, and when we saw it at work, the pump was making about 900 revolutions a minute. Carrett's steam pump is on an adjacent spot, and to the side is Dunn, Hattersley, & Co.'s apparatus for testing the strength of wood, cables, and other articles. On the wall above are a series of drawings of cranes, turntables, traversers, and other railway apparatus, also by Dunn, Hattersley, & Co. of Manchester. Whitworth has near here his splendid set of machine tools, for which the large medal of honour has been justly presented to him. For engravings and descriptions of these tools, we may refer our readers to the "Imperial Cyclopædia of Machinery," edited by W. Johnson, Esq., C.E., the collection of machines exhibited having recently been published in that work. Near these machine tools is a large working model of the engines of the *Wonder*, on the atmospheric system, by Seaward & Capel, to whom a first-class medal has been given. Near the last is the beautiful large working model of the engines of the *Simla*, by Tod & Macgregor, who have received the medal of honour. These engines are of the geared class, with upright cylinders and four rods to each piston, the crank shaft running between the rods, and lying very close down to the cylinder covers. Sheppard, Hill, & Spink of Leeds exhibit a set of several machine tools, amongst which is an immense lathe, with an interrupted bench, and carrying a disc-fixing plate 8 feet in diameter. There are also some other machine tools from Leeds—from Smith, Beacock, & Tannett, and from Buckton & Co. The machines by the last-mentioned firm are chiefly for making circular saws, and for dividing and cutting out the teeth of wooden spur-wheel patterns, and a first-class medal has been awarded for them. Not far from these machines is the fine slotting machine, by G. & A. Harvey of Glasgow, already engraved and described in this *Journal*.* Lewis & Sons of Manchester show some boring, turning, and planing machines; and Muir of Manchester his improved tool-grinding stones. Near these are—Codyer's machine for crushing ores; Coffey's model of an evaporating apparatus; Chaplin's portable forge and duplex-pressure blowing fan, both fully described in this *Journal*;† Eassie's railway trucks and brakes; Models of carriages and tenders fitted with Newall's patent railway brake; boiler tubes from the Birmingham Patent Tube Company; and various specimens of tubes by Russell & Sons of Wednesbury. Mr. P. R. Jackson of Manchester shows here his patent railway wheel tyres and wheels, his improved steam cylinder piston, and his apparatus for moulding toothed wheels. It was to this last-mentioned apparatus that we referred, when describing an apparatus for a similar purpose shown in the French machinery space. In Mr. Jackson's apparatus, the toothed rim of the wheel is moulded in segmental portions, by means of a segmental pattern comprehending any small convenient number of teeth. After each segment is moulded, the pattern is moved into a new position, by means of mechanism which insures an accurate readjustment, the first tooth of the pattern being put into the corresponding recess at the end of the last segment moulded. This system of moulding evidently surpasses the French mode, as regards its elements of accuracy.

We next enter a small space occupied by a few machines from Canada, consisting of—a cabinet-maker's work-table, by Rodden of Montreal, arranged for doing a great many different kinds of work, simply constructed, but strongly put together, and offered at a very low price. A first-class medal has been awarded for it. A machine for making cut nails is furnished with a self-acting feeding contrivance, which turns over the strip of metal from which the nail is cut. A mortising machine is shown, in which the mortising chisel is hollow, and has a boring tool inside it, serving to clear out the wood and to assist the mortising action.

The United States machinery has a very few representatives here, just beyond the Canadian space. The chief attraction is a number of stitching machines, arranged in a stall and kept vigorously at work. The most valuable invention represented here is Blanchard's system of bending timber for shipbuilders' use, a description of which will be found in our American Notes.* The same inventor exhibits two ingenious machines for cutting irregular forms, such as busts, in the lathe. King's steam-washing machines already described by us † are here; and, finally, a metal plate or sheet cutting machine, in which a scissors-edged disc is made to roll along a fixed rectilinear edge.

The remainder of the Annexe—a very small space—is occupied by a few odds and ends from the North European countries: such as, a sugar boiler from Amsterdam; a vertical cylinder stationary engine from Stockholm; Carlsund's screw engines from Sweden, the same as exhibited in the 1851 Exhibition; Holms' screw-propeller, full size, a model of which we have already alluded to as in the English department; a simply-designed pair of screw engines from the Netherlands; and a screw-geared ship's rudder apparatus from Norway. This completes our notes on the contents of the Annexe.

Between the Annexe and the main building, and on each side of the intermediate Panorama erection, are two irregular pieces of enclosed ground, containing a few objects in the open air, besides some small sheds covering agricultural machines and products, and carriages—railway and road—chiefly belonging to French exhibitors. In one of the carriage sheds is shown a railway axle journal, with spiral grooves for spreading the lubricating matter; and in the same place is also shown a complicated rail-fastening, by Barberot. A large brass screw-propeller, belonging to a French vessel of war, is exhibited in the open space. This screw has four narrow blades placed in pairs, one of each pair being a short distance immediately behind the other, so that, when the propeller is out of use, and placed with its blades vertical, these blades have very little impeding action upon the vessel's progress. Near the screw is a pretty screw yacht, and adjoining this an anchor, on Rogers' system, of a size considerably larger than that exhibited in the nave of the main building. Railway turntables occupy another spot; and at a little distance off, the capabilities of some hydraulic cement are exhibited in the union of two pieces of stone, to the lower one of which an immense weight is suspended without drawing the stones asunder. Swiss cottages, summer-houses, iron railings, and garden ornaments, in great variety, occupy a considerable portion of the open space, whilst in one corner there is a small erection containing various astronomical and optical instruments, and some photographs of eclipses of the moon.

With this we for the present conclude our series of articles on the Paris Exhibition.

By this time, the vast collection of articles has been scattered to a thousand homes. A great proportion of them will, in all probability, carry promising seeds of progress into distant nooks of the earth, infusing new elements of improvement, and supplying materials for the development of emulative struggles towards perfection in quarters hitherto barren of energetic skill. The picture of the whole show will long remain impressed upon the minds of its observant spectators, and, as in the case of our spectacles of 1851 and 1853, the hints gathered by a mere examination will gradually make themselves heard and seen in the applied science of the entire civilized world. With this prospect before us, we have the still more gratifying reflection, that in our own country we yet possess our own "Crystal Palace." That vast exhibition, wonderful as well in its variety as in its majestic proportions and picturesque beauty, possesses the grand feature of a permanent school. The moment of triumph and the first blush of success are still upon it. It is in truth

> ———"its own great loveliness alway,
> And takes new lustre from the touch of time."

TRAVERSING CROSS-CUT CIRCULAR SAWING MACHINE AT THE ROYAL ARSENAL, WOOLWICH.

By Messrs. John M'Dowall & Sons, *Walkinshaw Foundry, Johnstone.*

(*Illustrated by Plate* 184.)

The wondrous mechanical stores of the "laboratory" in the Royal Arsenal at Woolwich, which we are so fond of showing off to inquiring foreigners as amongst the leading industrial achievements of our country, have lately received some important additions in the timber-converting machinery, invented by Mr. John M'Dowall of Johnstone, and erected by his firm. Two distinct forms of timber-sawing machinery, put up by this Scottish firm, are now in successful work in the arsenal. One of them is a cross-cut circular sawing machine, contrived so that the saw comes upon its cut against the timber, and not the timber to the saw; in the other example, the saw is stationary and of reciprocatory action, being a modification of the ingenious system of stretching saws, illustrated by us in our Plate 123, by the "high-speed tensional sawing machine" of the same makers. Both arrangements present features of great novelty, and both are therefore fittingly selected for the examination of the readers of the *Practical Mechanic's Journal.*

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* Page 6, Vol. VIII. † Page 225, Vol. I., and pages 64 and 209, Vol. VI.

* Page 90, Vol. VII. † Page 206, Vol. VII.

In the instance of the traversing circular saw, the saw disc itself is a great curiosity, being nearly seven feet in diameter, the largest yet made from one solid piece of cast-steel. Its driving gear is also a novelty, the saw spindle being totally unconnected with the actuating power, which communicates its motion to the saw disc through a couple of frictional cones, embracing the saw disc, one on each side, and rotating in concert at a high rate.

Our Plate 184 exhibits a full side elevation of this sawing machine in complete working order. Its foundation consists of a cast-iron bed-plate, A, 70 feet in length, that is to say, of the entire width of the saw-mill house. This base plate is disposed horizontally upon stone bearers on a massive masonry foundation, in a sunk area under the mill floor, and in front of the vertical saw frames; and it is similar to the bed of an iron planing machine, occupying a breadth of about six feet. This bed-plate has upon it a heavy travelling carriage, B, mounted upon rollers capable of traversing along the bed-plate as upon a railway. The carriage sustains a pair of parallel vertical bracket standard pedestals, C, the two bearings in which form centres for the spindle acting as the supporting centre of the long differentially-curved beam, D, which has liberty to vibrate between the standards; this beam is composed of a central inverted T piece, answering as the suspending portion, and two long beam pieces bolted to it fore and aft. The after portion, or that to the right, is fitted with a toothed segment, E, whilst the opposite length is forked, or formed with a long deep double eye, to receive the bearings of the spindle of the circular saw, F. This vibrating beam support for the saw affords the means of setting the saw disc above or below the floor line, G, of the mill at pleasure; this being effected by turning the vertical spindle, H, accordingly. This spindle, which is supported in collar bearings in bracket pieces cast upon the pillar, I, of the carriage, carries at its lower end a bevil pinion in gear with a corresponding pinion fast upon a short horizontal shaft, which again carries a spur pinion in gear with the spur wheel, J; the shaft of this wheel carries a small spur pinion in gear with the toothed segment of the large vibrating beam. The two spindles of this short train of gearing are carried in bearings in the brackets, K, on the traversing carriage, so that the entire arrangement works together. The other spindle, L, having a double hand-lever on its upper end, serves for effecting the traverse of the saw carriage along its bearing rails; this spindle, L, passes down the centre of the pillar, I, and its lower end carries a spur pinion in gear with a spur wheel on a vertical stud spindle in the base of the carriage frame. The stud spindle of this wheel carries a spur pinion in gear with a horizontal toothed rack, extending along the whole length of the bed-plate. Thus, by turning the handle of the spindle, L, a powerful traversing force is obtained for setting the saw at any horizontal position in the house. The hand-lever being capable of transhipping from one spindle to the other, the horizontal and vertical shifts of the saw can be performed with great facility and convenience.

Immediately over the saw, and on a level with the working floor, G, of the mill, there are two lines of cast-iron plates laid across the entire width of the house, and between these plates there is a space, 1¾ inches wide, to allow of the saw's elevation for operating upon the timber at any part of the mill. The two shafts, H and L, for elevating and depressing the saw, and for traversing the carriage, pass through this opening, and as they may be misshipped at pleasure, the floor may at any time be cleared from all obstructions. The rotating cutting action of the saw is communicated through the spindle which works in the bearings of the standards, C, and forms the centre for the vibrating beam, D, this spindle carrying a belt pulley for the endless driving belt, M; on the same spindle are two opposed mortised wooden-toothed bevil wheels, O, each working into a cast-iron bevil pinion, P, set one on each side of the saw blade on an inclined shaft, the after end of which runs in a bearing carried by the central portion of the main vibrating beam; whilst the front end of the spindle is set in a bearing adjustable by a screw and dovetail face piece on the front curved end of the beam, D. This nicety of adjustment is necessary for setting the buff-leather cone pulley, carried by the inclined shaft on each side of the saw, hard up to the disc face, to nip it firmly near its periphery. With this ingenious arrangement, the whole of the saw disc is available for cutting, from the circumferential teeth quite up to the central binding washers, there being no pulleys in the way of the timber, as there are when saws for cross-cutting are driven in the usual way.

The saw works at the rate of 300 revolutions per minute, the actuating power being communicated to it by the endless belt, M, extending across the whole width of the house along the bed-plate, A, being supported by double rows of loose carrying pulleys, and directed over the pulley of the central driving spindle by the two guide pulleys, Q, running on studs carried by the main beam.

The log being cut, is represented at R, on the iron plates of the working floor of the house. The saw has just entered the log, and the observer can thus clearly make out how largely the disc is rendered available in cutting. A 3-feet log can be cut by this machine in fifty seconds. It has been fitted up as an auxiliary in the cutting of all heavy timbers ranging from 2½ to 5 feet on the side, for which purpose six vertical saw frames have just been erected by the Messrs. M'Dowall. These vertical saws are contained in a single building, in front of which is the circular sawing machine for cross-cutting the timber previous to its passing into the vertical frames. The objects looked to in this arrangement were, rapidity of action, the saving of manual labour in lifting heavy timbers to a separate saw for cross-cutting them, and the economy of space within the premises; for it must be remembered that, according to Mr. M'Dowall's design, the placing of a log for being cross-cut, is tantamount to placing it in position for introducing it into the vertical frames. The cross-cutting machine, whilst it saves the labour of extra lifting, occupies no room on the mill floor, as it is all beneath the floor line. Besides this, as it can be brought to any part of the house free of all the upper works of the mill, it offers no obstruction to the process of lifting or cutting timber throughout the building.

The value of the great feature of bringing the saw to the timber in this way is obviously important, where the operation of cross-cutting is to be performed with rapidity, and at different parts of a mill-house, without interfering with the other operations of the vertical saw frames, to which it plays but a secondary part.

ROYAL INSTITUTION OF GREAT BRITAIN.

When a new session is about to commence, it will not be unprofitable to review the past—to take a running glance at actual performances by way of exercise of vision as regards promise. Our readers are aware that during the last season, we have not, as we had been wont to do, regularly reported the proceedings of this society, but they will have observed that the space heretofore appropriated to it has been occupied with matter more immediately connected with our objects. We now propose to show how the Institution has supported its character during the last year, and to give our readers some general ideas of the "large discourse" which it has been its will to hold during that time.

The printed proceedings of the year 1854–1855 are before us, and we are glad to find that many new members have been elected, most of whom are likely to add to the well-earned reputation of the establishment. The lists of donations of books, &c. is increasing in length, and the volumes presented have been for the most part of enduring interest. On this point, before we enter upon the topic before us, we cannot but remark upon the very numerous publications which one gentleman alone has, from time to time, presented to the library in the course of a few months. Connected with the Institution from his earliest days, he has all along thrown the whole weight of his extensive, general, and special attainments and genius into its resources, and has as generously handed over to the library the numerous donations which have been made to him, by all bodies in the scientific world, as a homage to his own exalted position in it. Michael Faraday may continue to add to the literary riches of the foundation upwards of a hundred publications by the year, and do so stealthily in a corner, but we, for ourselves, are disinclined that such real munificence should be mentioned only in the printed reports of this association.

There is another honorary officer of the Institution to whom the thanks of all are equally due, for his continuing efforts and success in ministering to its interests. Upon the Rev. John Barlow has for many years devolved the duty—or rather from his admirable love of these things, he has imposed it on himself—that of selecting lecturers, and arranging and suggesting subjects for the lectures in general, and for the Friday evening discourses more especially—a very delicate task indeed, and requiring much tact, knowledge of mankind, and scientific pursuit. During the past season, his efforts have been singularly successful in bringing before the members, and the public whom they have the privilege of introducing, most of the uppermost subjects in scientific thought.

Faraday has occupied three of the evenings. His trumpet has sounded "On electric conduction," "On Ruhmkorff's induction apparatus," and

"On some points of magnetic philosophy." He began the series with the latter, and flew off to his recent favourite topic concerning gravitation, its connection with magnetism, and its relation to power in general. It is probably, says he, of great importance that our thoughts should be stirred up at this time to a reconsideration of the general nature of physical force, and especially to those forms of it which are concerned in actions at a distance. At present we are accustomed to admit action at sensible distances, as of one magnet upon another, or of the sun upon the earth, as if such admission were itself a perfect answer to any inquiry into the nature of the physical means which cause distant bodies to affect each other. That gravity should be made inherent and essential to matter, so that one body may act upon another at a distance through a vacuum, without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is, as Newton says, a great absurdity. No doubt; and no doubt it demonstrably appears unnecessary to imagine some, or discover that actual physical medium which may account for the facts observed, and hitherto and still produced as illustrations of the general law. Mr. Faraday has proved, over and over again, experimentally, that neither of the magnetic dualities can appear alone; and that, when they are developed, they are in equal proportions and closely connected—to all appearance essentially connected. A power is preserved by antagonism; and the physical philosopher, in his proof of this, but illustrates what the moral philosopher has eternally before him. The conservation of power is now a thought, says the professor, deeply impressed upon the minds of philosophic men, who as a body appear to admit that the creation or annihilation of force is equally impossible with the creation or annihilation of matter. We cannot stay to discuss whether the analogy is perfect—we think not; and hope hereafter to find a new philosophy, which shall arise founded upon the most simple facts, which shall account for these apparently inscrutable courses of action, and show their relation to the general mass, of which they form but an infinitesimal part.

In another of his high discourses, Faraday considered the question, "Whether an electrolyte has any degree of conduction proper?" which, since the time he laid down the law of definite electrolytic action, has been of continually growing interest; the experiments fitted to probe the question having been carried to a very high degree of refinement. The result of his own researches is a suspended judgment. In his last lecture he descends to describe one of the foremost instruments of magneto-electric research of our times, Ruhmkorff's electro-magnetic apparatus; he is not, however, contented with this, but refers to the hopes realised by the instrument. The results obtained by Grove, apparently referable to polarization, were adverted to, as also the remarkable transverse bands presented in the recurring discharge across very rarefied air. Founded as the apparatus is, by its core and its wires, upon the joint effects of electro-dynamic and magneto-electric induction, he observed that it gave great promise of aid in the investigation of that condition of either the space or the ether which is about magnets, and around every discharge of electricity, whether in good or bad conductors, and which is expressed by the terms (themselves synonymous) of the magnetic or the electro-tonic state.

Professor Tyndall has volunteered two discourses. The one, "On the currents of the Leyden Battery," and the other "On the nature of the force by which bodies are repelled from the poles of a magnet." The phenomena of voltaic induction are well known, and the inquiry, whether frictional electricity produces analogous phenomena, has been prosecuted by Dr. Henry, and the able and experienced electrician, Dr. Riess of Berlin. The researches of these gentlemen constituted the first lecture of Dr. Tyndall, while the last-mentioned was a popular expression of the Bakerian lecture for the present year, which the lecturer had the honour to deliver before the Royal Society. The Astronomer-Royal, in a lengthened evening, popularised the pendulum experiments lately made in the Harton Colliery, for ascertaining the mean density of the earth, and concluded his observations by mentioning, that if a calculation of the earth's mean density were based upon the determination he had arrived at, using a simple theory to which he referred, it would be found to be between six and seven times the density of water. But he stated it as necessary to take into account the deficiency of matter in the valley of the Tyne, in the hollow of Jarrow Slake, and on the sea-coast, and that it was further necessary to obtain more precise determinations of the specific gravities of the rocks about Harton Colliery than have yet been procured. He also stated that measures were in progress for supplying all these deficiencies, and that it seemed probable that the resulting number for the earth's density would probably be diminished by these more accurate estimations.

Professor Owen—ever welcome when there is anything new to be told, and he has the telling of it—ever heard with interest by the merest tyro in science, as well as by men of his own professional standing—discoursed very largely "On the Anthropoid Apes, and their relation to man." In this discourse, the structure, more especially of the bones and teeth of the most highly organized apes, the orang-outangs and chimpanzees, was compared with that of the human subject; in reference to the hypothesis that specific characters can be so far modified by external influences operating on successive generations, as to produce a new and higher species of animals, and that thus there had been a gradual progression from the monad up to man. In the course of this discourse, the Professor observed upon the different races of mankind—few or many, according to the views of different ethnologists—and adduced his reasons for attributing them all to one species, and ascribed the differences observed amongst them to varieties only. He then analysed the osteological differences between the Gorilla, the most anthropoid of all known brutes, and man, in reference to the hypothesis of the origination of species of animals by gradual transmutation of specific characters, and that in the ascending direction. And he stated that the gorilla, the great chimpanzee, differs both from the orang and man in one cranial character, which no difference of diet, habit, or muscular exertion could be conceived to affect; namely, the prominent superorbital ridge. And he concluded that the feeble indication of the superorbital ridge in man, aided by the expansion of the frontal sinuses, is as much a specific peculiarity of the human skull, as the exaggeration of this ridge is characteristic of the chimpanzee's, and its suppression of the orang's. He mentioned also that the equable length of the human teeth, and the concomitant absence of any diastema or break in the series for the adjustment of the upper canines, and of any sexual difference in the development of particular teeth, are to be viewed by the light of actual knowledge, as being primitive and unalterable specific peculiarities of man. He relied upon such facts as standing in contravention of the hypothesis of transmutation and progressive development, until the supporters of that hypothesis are enabled to adduce the facts and cases which demonstrate the conditions of the modifications of such characters. It is not without interest, he remarked, to observe, that as the generic form of the *quadrumana* approach the *bimanous* order, they are represented by fewer species. The gibbous (*hylobates*) scarcely number half a dozen species; the orangs (*pithecus*) have but two species, or at most three; the chimpanzees (*troglodytes*) are represented by two species. Professor Owen trusted that he had furnished the confutation of the notion of a transformation of the ape into man, which had been anticipated by old Henry More in his "Conjectura Cabbalistica." Mr. Huxley's formed a discourse on a more general subject, viz., "On certain zoological arguments commonly adduced in favour of the hypothesis of the progressive development of animal life in time;" and attempted to combat them with reasonings from parts of natural science.

Turning from such like high themes, we come upon chemistry, and Dr. Odling very pleasantly compelled us to plunge after him into some of the deep waters with which it abounds. "On the constitution of hydro-carbon," he was, as he usually is, profound and intelligent. From his being so conversant with symbolic chemistry, he bids fair to arrive at some quasi chemico-mathematical formulæ which may immensely advance this aspiring science. He quite amused the audience with his singularly extensive knowledge of the modern language of chemistry. One of his observations deserves record, as being, although universally true, scarcely ever remembered. Each of the different theories, said he, that have been propounded concerning the chemical constitution of bodies, is true in reference to one particular aspect, untrue in reference to all others. Theories are of the highest service when they enable us to look upon a larger number of bodies from a single point of view—of the highest detriment when they prevent us from making use of all other points of view. To regard a body, or a class of bodies, exclusively in one aspect, or, in other words, to view all compounds by the light of a single theory, is necessarily to neglect a whole host of phenomena and relations. He has the most complete knowledge of a compound, who is capable of changing his position, and looking at the body from every possible point of view. The Rev. John Eyre Ashby, followed "On (so called) catalytic action and combustion, and theories of catalysis." The study of catalysis was explained as a study of forces, and as comprehending the conditions under which force is exerted in a peculiar manner in chemical decompositions and combinations, and of the nature of the force, only as compared with forces at work in chemical changes, which are commonly thought to be better understood. Dr. Ashby defined catalysis as the action by contact of one substance upon another substance, or group of substances, whereby chemical changes are effected, while the first substance remains finally unchanged. Berzelius considered that it represented a new force; and Dr. Ashby thought, that as catalytic combustion by the sesquioxide of iron is first set up at a temperature far below redness—that even a rusted nail may be sufficiently active—and that, in many cases of fermentation, inflammable vapours may be disengaged and much heat evolved, it is not unreasonable to suppose, that in this way we may account for some instances of what is commonly called "spontaneous combustion." The Rev. John Barlow, M.A., F.R.S., vice-president and secretary, followed, and discoursed in his usual able manner "On the application of chemistry to the preservation of food." From his numerous illustrations and scientific explanations, he had evidently studied the subject deeply—undoubtedly one of great interest, and vast social importance. We are always glad to have Mr. Barlow before us on any of the numerous topics to which he has directed his attention, and the mysteries of which he has conquered.

Sir Charles Lyall then descanted "On certain trains of erratic blocks on the western borders of Massachusetts, United States;" and maintained, with his usual force and elegance, the glacial theory with regard to the origin of their deposition. "The mining districts of the north of England" afforded another evening's entertainment, and Mr. Thomas Sopwith detailed some very interesting facts; he stated, among other things, that the production of the coal mines of the Northumberland and Durham districts now reaches an amount, little, if any, short of 14,000,000 tons annually. In round numbers, and as conveying a general approximation, it may be considered that of this quantity 6,000,000 are destined for London and the coast trade, and about 2,500,000 exported abroad; the consumption of coal for coke (inland, coast, and foreign) is about 2,500,000; colliery engines and workmen consume upwards of 1,000,000 tons, and the ordinary local consumption of the district may be taken at about 2,000,000. As to lead, the total produce had been estimated at 100,000 tons; and, as a rough approximation of the last few years, it might be considered that six-tenths of this, or 60,000 tons, are raised in Great Britain; England alone producing about 40,000 tons. The north of England lead-mining districts furnish about 20,000 tons, and one moiety of this is raised in the W.B. mines of Mr. Beaumont—the initials W.B. (William Blackett), being the well-known trade mark of the lead produced from these, the most extensive lead mines in the world. As to iron, the lecturer said that little more than 100 years ago, the quantity of iron made in this kingdom was about 25,000 tons, and at the beginning of this century 170,000 tons. Fifteen years ago, this quantity had increased to 1,500,000 tons, and at present the production reaches, and probably exceeds, 2,500,000 tons. Mr. Sopwith mentioned a fact not universally known; after adverting to the localities which formerly produced, or do now produce, household, coking, or steam coal, allusion was made to the Roman Wall, the east termination of which is midway between Newcastle and the Sea, gave rise to the well-known name of Wallsend coal. A large colliery at that place having produced an excellent description of household coal, and the high estimation of Wallsend coal, led to the appellation being extended to others.

The war was not likely to escape attention even in this arena of science, and did not. Mr. Edward Jekyll described "Siege operations;" and Dr. Gladstone very elaborately explained the characters of "Gunpowder and its substitutes," and informed us, as the result of his researches, that even in the present state of chemical science, the triple compound discovered by the alchemists of old, could not be effectually superseded by any other known compound.

The sanatory topics were not forgotten, Dr. John Stenhouse spoke upon "The economical applications of charcoal to sanatory purposes." After noticing the three species of charcoal, wood, peat, and animal charcoal, and giving an account of his own and Mr. Turnbull's experiments—which consisted in burying the bodies of dogs and cats in charcoal powder, and in covering them over with about a couple of inches of the same material, and proving thereby, that, so far from charcoal being an antiseptic, as was till recently universally believed, it was in fact precisely the reverse, and the influence this discovery had upon him—he stated that he was led to the construction of the so-called charcoal air-filter, first exhibited and described by him before the Society of Arts in February last. He explained it to consist of a thin layer of charcoal-powder, enclosed between two sheets of wire-gauze. One of these charcoal ventilators was erected about the end of 1854, in the justice-room at the Mansion-house. This apartment, from the position of several nuisances in the very narrow street from which it is ventilated, was usually so offensive as to have become the subject of general complaint. Since the erection of the charcoal ventilator, through which all the air entering the apartment is made to pass, all the impurities are absorbed, and the atmosphere of the room has become unexceptionable. From this success, the city authorities have fitted up the justice-room at Guildhall with a similar apparatus, which is giving equal satisfaction. The charcoal ventilator at the Mansion-house has never required any alteration, such as renewal of the charcoal or otherwise. The lecturer considered that these ventilators could not fail to prove eminently useful in all situations where foul air is apt to accumulate, such as in water-closets, in the close wards of hospitals, in ships, and in the back courts, mews, and lanes of large cities; all the impurities being absorbed and retained by the charcoal, while a current of pure air alone is admitted into the neighbouring apartments. In this way, pure air is obtained from exceedingly impure sources. Dr. Stenhouse also gave a sketch of the history and construction of respirators, from their first proposal by Dr. Beddoes of Bristol in 1802, till their description some 17 or 18 years ago by Dr. Arnott, in a lecture at the Royal Institution, and their being subsequently patented by Mr. Jeffreys, who first brought them into general use. He concluded by noticing that powdered charcoal had, during the last twelvemonths, been most successfully employed both at St. Mary's and St. Bartholomew's hospitals, and in other similar establishments, to arrest the progress of gangrene and other putrid sores. "A mode of providing an additional supply of Pure Water for London," was explained by Mr. John Dickinson—the great expense of which, and the enormous amount of opposition which the scheme would obviously excite, appearing the obstacles to its advantageous accomplishment for the general metropolitan public.

The fine arts have just been touched upon, in the very interesting and novel subject of "nature printing," which was very pleasantly explained and illustrated by Mr. Henry Bradbury, while Dr. Lacaita, in a discourse "On Dante and the Divina Comedia," upheld the agreeable associations of high literature. As incident to the subject, he attempted to prove that Dante had passed a portion of his youth at Oxford, and expressed a wish that some one of the sons of that seat of learning would inquire fully into the subject, to which as yet no attention had been paid, and to the glories of his "Alma Mater," add that of having received within her walls "the greatest poet of Christendom." The lecturer alluded to Mr. Pollock's recent translation of the Divina Comedia, as particularly noticeable for its faithful conveyance of the meaning of the original.

Colonel Rawlinson concluded the series of these agreeable evenings, by detailing before His Royal Highness Prince Albert, and a very brilliant assembly, the results of his more recent explorations on the sites of the ancient capitals of the Babylonian and Assyrian empires.

We must not conclude this notice without adverting to the pleasing facts, of a recent great increase in the new members of the Royal Institution, and its pecuniary prosperity, which latter fact we hope may induce the managers to add, in these hard times, to the small stipends of all the officials, who upon the close of this session thoroughly deserve the thanks of the members and the general public.

The Duke of Northumberland has been re-elected president, William Pole, Esq., treasurer, and the Rev. John Barlow, secretary, for the current year, which we hail with enlarged and no common anticipations.

MECHANIC'S LIBRARY.

Arts of the Middle Ages, Hand-book of, 8vo, 18s., cloth. Labarte.
Astronomy, Popular Lectures on, G. Tomlinson, sixth edition, 2s. Arago.
Chemical Philosophy, Catechism of, illust., crown 8vo., 6s. 6d. Horsley.
Chemistry, First Step in, second edition, foolscap 8vo, 5s., cloth. Galloway.
Geology, "Orr's Circle of the Sciences," Vol. V., crown 8vo, 5s. 6d. cloth.
Hydraulics, Elements of Practical, 8vo, 5s., cloth. S. Downing.
Hydrostatics, &c., "Hand-book of Natural Philosophy." Vol. II., 5s. Dr. Lardner.
Literary and Scientific Register and Almanack for 1856, 3s. 6d. Gutch.
Science and Art, Museum of, Vol. VIII., foolscap 8vo., 1s. 6d., boards. Dr. Lardner.
Science, Wonders of, foolscap 8vo, 6s., cloth. H. Mayhew.

RECENT PATENTS.

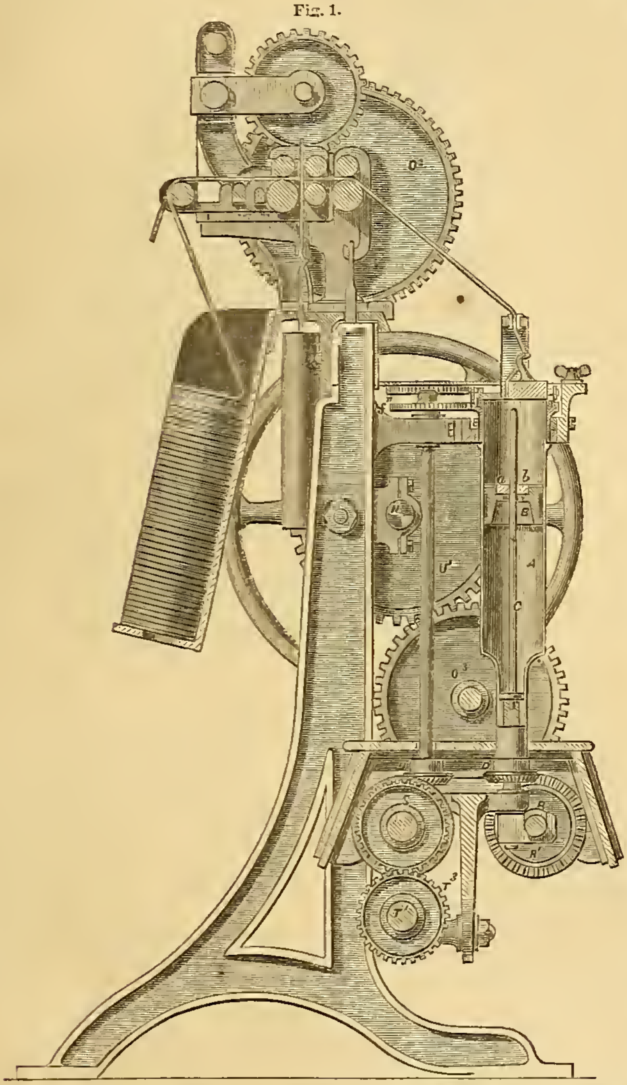
CAN COILING APPARATUS FOR COTTON SLUBBING AND ROVING FRAMES.

J. H. Johnson, *London.—Patent dated April* 10, 1855.

This is the communicated invention of M. Jean Beugger of Wülflingen, Switzerland. By it the slivers from the slubbing and roving frame are wound eccentrically upon a spindle in coils of uniform diameter, laid one over the other, each coil covering a portion of the coil going before it. Fig. 1 of the engravings is a sectional elevation of a slubbing frame fitted up in this way; fig. 2 is a vertical section of the upper fittings of one of the cans; and fig. 3 is a sectional plan of the eccentric coil movement.

A is a can, in the interior of which is fitted a piston, B, having its upper surface covered with cloth, *b*, in order to create the friction necessary on commencing a bobbin. The piston, B, is provided with an aperture through the centre, closed by a small disc, *a*, which, as well as the piston, is traversed by the spindle, C, the object of which is to withdraw the bobbin when it is finished. The lower extremity of this spindle is furnished with a bevil pinion, D, from which it receives a rotatory motion. At the upper part of the can there is a short tube, E. The lower part of the tube, E, rests upon a projection upon the can, and it is furnished at *e* with teeth, by means of which it receives motion from the spur-wheel, *f*. To the tube, E, there is united, by the friction produced by a ring of leather, *g*, a ring, *h*, having an eccentric opening, *i*, which is closed by a disc, I, having teeth on its edge. The disc, I, is maintained in its place by a projecting flange, fitting into the eccentric opening, *i*, and a similar flange above, fitting into an eccentric opening in the plate, *k*. Around the upper edge of the tube, E, is fitted, so as to turn loosely, a ring, *l*, the exterior and interior circumference of which are both provided with teeth. By means of its external teeth it receives motion from the wheel, *m*, and its internal teeth serve to communicate this motion to the disc, I, through the segmental opening, *n*, in the ring, *h*. The movements of these parts of the apparatus are as follow:—

Fig. 1.



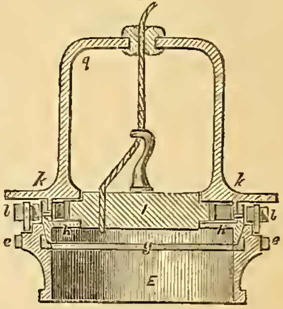
1st, The can turns upon its own axis by the action of the bevil-wheel, D.

2d, The eccentric disc, I, turns round its axis through the agency of the ring, *l*.

3d, The disc, I, has also another circular motion around the top of the can, being carried by the ring, *h*, which receives its motion from the tube, E.

In using the apparatus, it is necessary that facility should be afforded for withdrawing the spindles with the complete bobbins, and replacing them by empty spindles, without displacing the pieces, E and *l*, and without throwing the wheelwork out of gear. This object is attained by merely uniting the ring, *h*, which carries the eccentric disc, I, to the tube, E, by the friction of the leather ring, *g*. The ring, *h*, can thus be readily removed, carrying with it the piece, *k*, which supports the guide, *q*, for the sliver. There is also an arrangement by means of which the pieces, *k* and *l*, can be separated when necessary. The piece, *k*, is furnished with one or two springs, *o*, which press the pins, *p*, into corresponding holes in the piece, *h*, thus keeping the two pieces united. When it is necessary to separate the pieces, *h* and *k*, it can be done by pressing in the pins, *p*, which can readily be done by means of the pincers represented in fig. 4. As the interior surface of the upper edge of the ring, *h*, is bevilled, it is not necessary to use the pincers in uniting them, as the bevilled edge presses the studs in, and the spring, *o*, presses them out when they come opposite to the holes in the ring, *k*. The sliver, on leaving the drawing rollers, passes through the guide, *q*, and one of the holes in the disc, I, and its end is placed upon the cloth or other surface of the piston, B. The three combined movements above described will arrange the sliver in eccentric rings or coils, the regularity of which is insured by the friction resulting from the piston being at the top of the can, close to the disc, I. As the bobbin increases, the piston descends gradually, until it reaches the bottom of the can, when the bobbin is complete. The pieces, *h*, I, and *k*, are then removed together, and as the elasticity of the bobbin would give it a tendency to spring out to a greater length than the spindle, it is compressed a little by a small disc of wood, pierced with a hole, which fits tight upon the spindle. The spindle, C, is then raised. The small collar with which the lower end of the spindle is furnished passes through the piston, and raises with it the small disc, *a*, and with it the bobbin, which is thus drawn entirely out of the can. In order to supply a fresh spindle, the piston is raised to the top of the can by a kind of hook, and a fresh spindle and disc, *a*, is supplied. The pieces, *h* and *k*, are then replaced, and the operation proceeds as before. N is the main driving shaft, which is furnished with a fast-and-loose driving pulley and fly-wheel, and a spur-wheel, *o*, which, by means of the intermediate or carrier wheel, O^1, drives the wheel, O^2, upon the end of the front drawing roller. The second drawing rollers are actuated by means of the spur-wheels, P, P^1, P^2, and P^3, and the back drawing rollers are driven by means of the wheels, Q, Q^1, and a pinion, Q^2, on the shaft of the second drawing roller. The wheel, O, upon the main driving shaft, also drives the pinion, O^4, by means of the carrier-wheel, O^3. On the shaft, R, of the pinion, O^4, are keyed the bevil-wheels, R^1, in gear with the bevil-pinions, D, of the cans. The wheel, O^3, also drives a pinion on a second shaft, S, which carries the bevil-wheels, S^1, in gear with the bevil-pinions, S^2, on the vertical shafts, S^3, which carry the wheel, *m*. The shaft, S, is also furnished at its extremity with a pinion, T, in gear with a second pinion, T^1, on a lower shaft, T^2. This shaft carries the wheels, T^3, which, by means of the wheels, T^4, drive the bevil-wheels, T^5, which are loose on the shaft, S, turning in the same direction, but at a different velocity. These wheels, T^5, gear with the bevil-pinions, U, upon the vertical shafts, U^1, which carry the wheels, *f*. The wheels, R^1, S^1, and T^5, are placed at considerable distances from each other, the intermediate cans driving each other by means of the wheels, V, with which each can is furnished, and all of which gear together. By this arrangement, it will be seen that some of the cans turn to the right hand, and some to the left, thus producing a difference in the direction in which the bobbins are wound, which, however, is of no consequence. This arrangement also permits all the wheels, *e* and *l*, to drive each other, and to drive the wheel, *e*, of one can by the wheel, *f*, turning in one direction, whilst the next wheel, *m*, turns in the

Fig. 2



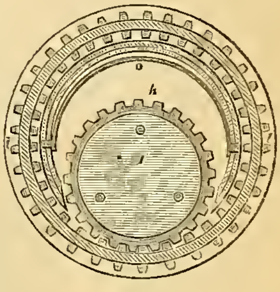
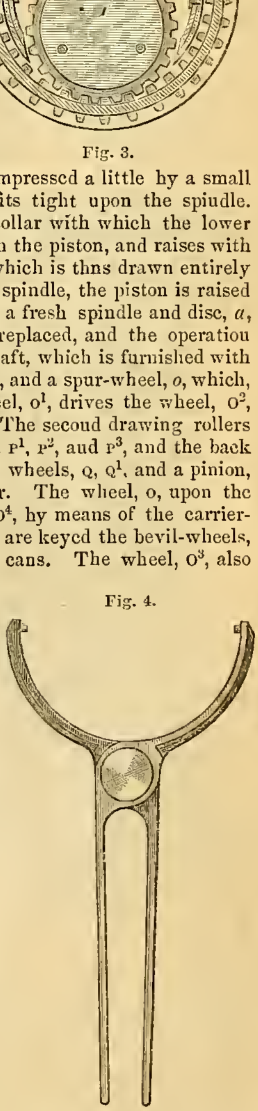


Fig. 3.

Fig. 4.



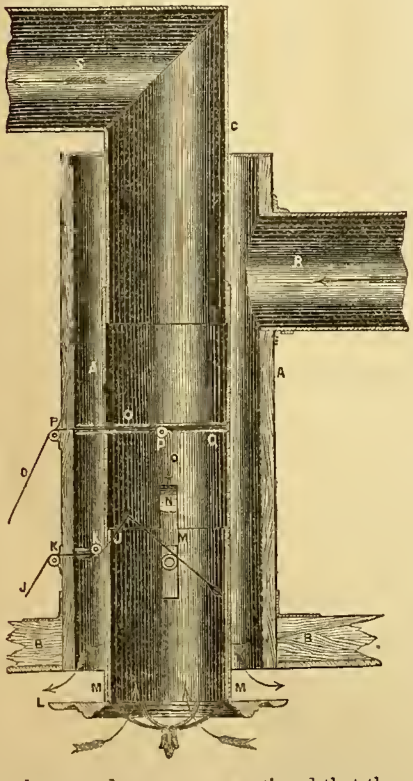
other direction, but drives the ring, *l*, of the adjacent can in such a manner that the ring, *l*, of the first can turns in the same direction as the wheel, *e*, and the can itself. This combination is merely for the purpose of allowing the shafts, S^3 and U^1, being placed side by side.

It is claimed for this machine, that its productive powers are very superior to those of its older rivals, whilst a diminished amount of twist is required.

VENTILATORS.

J. M'Kinnell, *Glasgow.—Patent dated March* 26, 1855.

Mr. M'Kinnell secures efficient ventilation in public halls, churches, dwelling-house apartments, ships' cabins, railway carriages, and other places, by means of a simple automatic apparatus, to be fixed in the roofs or ceilings of such places, this apparatus providing for a steady influx of pure atmospheric air, and for the discharge of the air which is vitiated by respiration, combustion, or other causes. The apparatus consists essentially of two tubes, arranged concentrically, and opening at their lower ends into the space or apartment to be ventilated. These tubes communicate with the external atmosphere at different levels, the vitiated air rising up the central tube, and passing off at the higher level, whilst the fresh air enters the annular passage, between the inner and outer tubes, at a lower level, and descends into the space or apartment below. Both passages are provided with suitable valvular mechanism for regulating the currents; that of the outer passage, at the same time, serving to deflect the downward current of fresh air, and spread it out horizontally, so as to prevent partial draughts.

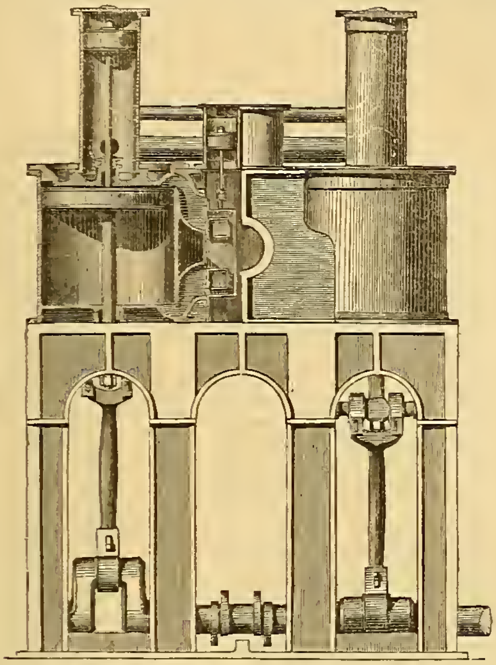


Our engraving represents a vertical section of one modification of the apparatus. In this arrangement, a tube, A, of wood, or other suitable material, is fixed in any convenient manner in the ceiling or roof, B, of the apartment or space to be ventilated. Inside this tube, and concentric with it, is placed a smaller tube, C, which is supported by radial ribs, D, or in any other convenient manner. The tube, C, projects a short distance above the outer tube, A, and may be surmounted by an ornamental cover or hood, from beneath the edges of which the vitiated air, rising through this central tube, escapes, passing through a perforated screen, which covers the opening, and prevents the introduction of foreign matters into the tube; or, instead of proceeding directly upwards, the tube, C, may be continued in a horizontal direction, as represented in the engraving at S. The upper end of the outer tube, A, may be open, in which case it is also covered by an annular hood, and the entrance space for the fresh air which passes down the outer tube is likewise defended by a perforated screen; or the inward current may be conveyed into the tube, A, by a horizontal branch, as represented in the engraving at R. The tubes, A and C, are so proportioned that the sectional area of the central tube, C, is about equal to the sectional area of the annular passage comprehended between the two tubes. When the apparatus is in action, the doors and windows of the apartment to which it is applied being closed, the vitiated air, which is heated, and consequently lighter than the external fresh air, rises up the central tube, C, on account of the greater length of this tube, whilst the heavier fresh air descends through the shorter external passage, A, and thus a constant current is kept up; the air, as it becomes vitiated and heated, rising and passing off, whilst its place is supplied by pure fresh atmospheric air from the outside of the structure. The valvular apparatus for regulating the currents consists in the case of the central tube, C, of a simple throttle-valve, I, set upon a transverse spindle inside the tube, and weighted on one side, so as to have a tendency to maintain a vertical position, leaving the passage full open. The valve is closed wholly or partially by means of a cord, J, conveyed over pulleys, K, to any point where it can be conveniently adjusted by an attendant. The valve appertaining to the outer air passage, A, is an annular flange or plate, L, which slightly overlaps the mouth of the passage, and is fixed to the bottom of a short length of tube, M, fitted to slide easily inside the tube, C. This valve is suspended by means of the bridle-piece, N, to which a suspensory cord, O, is attached, and this cord passes over pulleys, P, to any point where it can be conveniently adjusted by an attendant; a small tube, Q, being fitted across the tubes, C and A, to convey the cord to the outside of these tubes. When the valve, L, is drawn up as high as is possible, it completely closes the down draught passage, whilst, by letting it down more or less, the passage is correspondingly opened, and the current of air impinging upon the plate, L, is deflected and spread out in a horizontal direction, so as to be more uniformly dispersed over the apartment or space to which the ventilator is applied. The under side of the valve, I, may be ornamented in any convenient way, and the central opening communicating with the pipe, C, may be covered with a perforated rosette, T, to do away with any unsightly appearance, and to render the ventilator an ornament rather than otherwise to the place to which it is applied. The modification represented in the engraving is more particularly adapted for localities where it is necessary to conduct the currents in horizontal directions. The top of the tube, A, is closed, and the horizontal tube, R, is joined to it at one side, whilst the tube, C, has a horizontal tube, S, joined to it at a convenient point above the tube, A. The tubes, R and S, may be continued in any directions to the exterior of the structure to which the apparatus is applied, it being essential, however, that the tube, S, should emerge into the outer atmosphere at a higher level than the tube, R. It is also advantageous to place the mouths of the tubes, R and S, as far apart, both horizontally and vertically, as is convenient; and to carry out this arrangement as much as possible, the tube, C, may be continued vertically upwards, where it is convenient, whilst the outer air passage, A, may be made to communicate with the external atmosphere by a horizontal tube, R, as in the figure.

DIRECT-ACTING MARINE ENGINES.

R. Morrison, *Newcastle-upon-Tyne.—Patent dated May* 14, 1855.

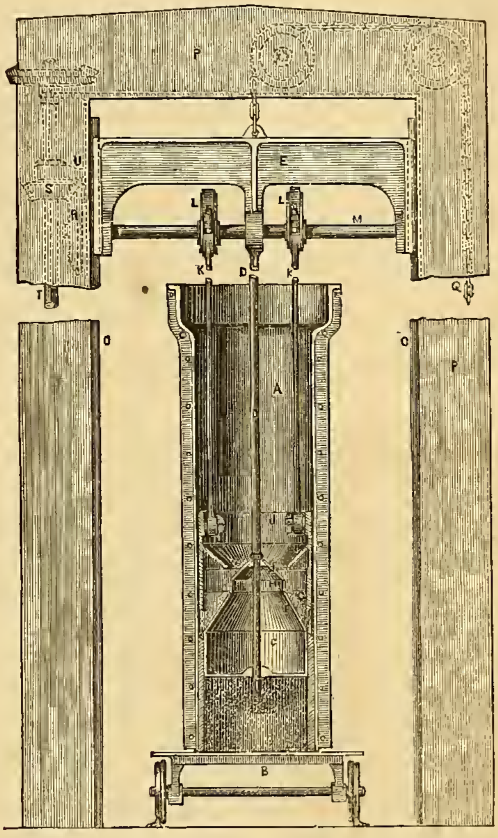
The class of direct-acting screw engines, in which a pair of steam cylinders are placed above the screw shaft, their pistons working out downwards towards the latter, possesses qualities and conveniences of arrangement which would bring it into more general use, were it not that the vertical reciprocation of the heavy moving parts causes an irregularity of motion, and a strain on the various joints and bearings, which considerably detracts from its efficiency. Mr. Morrison's present invention is directed to the removal of this defect, which he proposes to effect by balancing or supporting the heavy moving parts, such as the pistons, piston-rods, connecting-rods, and the valves and gear. The working steam itself is made to act as the balancing agent in these arrangements, by fitting up and attaching suitable steam cylinders and pistons to the proper parts of the engines. Our engraving is a side elevation, partially in section, of a pair of vertical-cylinder direct-acting engines, as constructed according to this improved system. In these engines the steam cylinders are mounted upon a cast-iron framing of simple design, being placed directly over the screw shaft which they drive. The steam piston-rods work out through stuffing-boxes in the bottoms of the cylinders, and are fitted with cross-heads working in slides, and upon which are jointed the connecting-rods which transmit the motion to the cranks of the screw shaft. The weight of the steam piston and its connections just mentioned, has, in ordinary engines of this class, a tendency to render the motion irregular, by accelerating the downward and retarding the upward stroke of the steam piston. The object of the present invention, which is to prevent this irregularity from taking place, is attained in the present instance by fitting upon the top of the steam cylinder, a cylinder of smaller diameter, and fitted with a piston which is connected to the steam piston by a rod. This rod may either be a continuation of the steam piston-rod, or it may be a separate rod fixed in the top of the steam piston, and it works through a stuffing-box in the cover of the steam cylinder. Steam is admitted into the small cylinder below its piston by a port and pipe which communicates with the valve-casing or steam pipe, whilst the upper part of this cylinder above the piston is in communication with the condenser by another pipe. Both of the steam cylinders are provided with similar details, and the steam pressure under the smaller pistons balances the weight of the steam pistons and their connections, the smaller pistons being of a size or area calculated to effect that object. The valves and their actuating details are balanced in the same way as the steam pistons. A pair of small cylinders are for this purpose bolted down upon the top of the valve-casing; and as the valve-casing is always full of steam, these cylinders are in direct communication with it by their open bottoms, so that the steam pressure acts on the under sides of the small pistons which work in the cylinders. These pistons are fixed by short rods to the slide valves, and are of a size or area calculated to balance the weight of the valves and their actuating details, the upper parts of the cylinders being in communication with the condenser by means of short branch pipes joining the pipe from the other small cylinders, so that the steam pressure below acts against a vacuum. The valve rods work out through stuffing-boxes in the bottom of the valve-casing, and are actuated by eccentrics on the screw shaft below. In this way the principal unbalanced weight of steam engines is completely compensated for, so that the engines work much more pleasantly, and develop much more actual work, than engines of the ordinary unbalanced kind, or engines with dead balance weights. It is obvious that this arrangement may be applied under a great variety of forms, more or less dependent on the special form of engine to be balanced.



MOULDING METAL PIPES.

D. Elder, *Glasgow.—Patent dated March* 24, 1855.

In the construction or formation of sand or loam moulds, to be used for casting metal pipes and other articles of parallel section throughout, or nearly throughout their length, Mr. Elder employs a system of mechanical ramming of the material of the mould, combined with the shaping action of a short length of the pattern, which produces the inner surface of the mould. The general arrangements involved in this system are especially applicable to the preparation of moulds for cylindrical pipes; but they are also capable of effective application in preparing the moulds for articles of rectangular or other transverse section provided such articles have their sides parallel throughout, or nearly throughout their whole length. Our engraving is a partially-sectioned elevation of one modification of the improved moulding apparatus, portions of the framing and rods being broken away to contract the length of the figure.



The apparatus is represented as arranged for forming a mould for a pipe of cylindrical contour. This mould is formed in a cast-iron mould box, which is usually made in two halves, whereof one is supposed to be removed; the other, A, being represented as placed upon the carriage, B, upon which the mould is subsequently carried away. The interior of the mould box, A, is sufficiently larger than the exterior of the pipe to be cast, to allow of the necessary thickness of loam or mould material to be introduced. The internal surface of the mould is formed upon a short pattern piece, C, represented in vertical section, and connected by a rod, D, to an overhead cross-head, E. The lower portion of the pattern piece, C, is cylindrical, and corresponding to the external diameter of the pipe to be cast. This cylindrical portion of the pattern piece is surrounded by a conical part, F, upon which are formed or fixed a series of radiating feathers, G, the external edges of which are flush with the surface of the lower part of the pattern piece. Above the part, F, is a short cylindrical portion, H, and this last is surmounted by the cone, I. The rammer is a cylindrical casting, J, the lower part of which is accurately turned internally to fit the cylindrical pattern, C, and to slide upon the feathers, G, which act as guides to it when it is elevated above the cylindrical portion, C, of the pattern piece. The external diameter of the rammer is slightly less than the internal diameter of the mould box, A, and its bottom ramming edge is bevilled. This ramming edge may, however, be shaped in various ways, as may be found most suitable in practice. The rammer is suspended and worked by two rods, K, which are fitted to a pair of eccentrics, L, upon a horizontal shaft, M, carried in bearings in the cross-head, E, above. The revolution of the eccentrics communicates a vertical reciprocating motion to the rammer, J, causing it to ram down the sand or mould material between the pattern, C, and the side of the mould box. The sand or mould material is supplied continuously, in any convenient manner, in at the mouth of the mould box. It first falls on a conical flange, N, cast upon the inside of the rammer, J. The inner edge of this flange loosely fits the short cylindrical portion, H, of the pattern piece, and when the rammer is near the bottom of its stroke, the part, H, fills the central opening in the flange, J, and cuts off the further descent of the sand. When, however, the rammer is elevated, the sand falls freely through the opening in the flange, J, and running down the conical surface, F, between the feathers, G, enters beneath the bottom ramming edge of the rammer, this edge being at the time elevated a little above the cylindrical portion, C, of the pattern piece, so as to let the sand descend beneath it. The supply of the sand may be modified by varying the shape of the top of the pattern piece, and by suitably proportioning the passages through which it descends. When the sand becomes of sufficient consistence beneath the ramming edge, the rammer not being able to descend to the full extent of its stroke, a back strain takes effect on the shaft, M, and cross-head, E. This cross-head is formed with slides to work upon the vertical guides, O, of a stout cast-iron frame, P, so that when the back strain occurs the cross-head rises, lifting the pattern piece, C, with it. To effect this lifting movement, the strain and the resisting consistency of the sand beneath the rammer from which this strain is derived, must be sufficient to lift the weight of the cross-head, E, and parts suspended from it, and also to overcome the frictional resistance of the pattern in the mould. In ordinary cases, the weight and resistance will be too great—that is to say, the sand beneath the ramming edge will become harder than is desirable before it will cause sufficient strain to lift the cross-head and pattern details, and it will therefore be necessary to counterbalance these parts to a greater or less extent by means of a weight attached to a chain, Q, which, passing over pulleys in the framing, P, is connected to the cross-head, E, and exerts a lifting action upon it. It will be obvious to the practical man, that, by proportioning the balance weight, the degree of hardness of the mould may be regulated with the greatest nicety, whilst the degree of hardness will be perfectly uniform from the bottom to the top of the mould, the rammer and pattern gradually rising as each increment of the mould is brought to the proper degree of hardness by the ramming action. It now merely remains to describe the manner of driving the machine. The shaft, M, by the rotation of which the whole machine operates, has keyed on one of its ends a bevil wheel, R, which is in gear with a bevil wheel, S, upon a vertical shaft, T, to which last motion is communicated from any prime mover in any convenient way. The bevil wheel, S, is loose upon the shaft, T, but being fitted upon it square, or with a groove and feather, is driven by it, whilst it travels upon it longitudinally, so as to be always in gear with, and drive the bevil wheel, R, the movements of which it is made to accompany by a collar bracket, U, embracing its boss, and fixed upon the cross-head, E. As there are no rotating movements in these arrangements between the rammers and the patterns and the mould boxes, it is obvious that articles of various transverse sections may be moulded, as hereinbefore described, with as much ease as cylindrical articles.

DRAINAGE OF MOULDED SUGARS.

J. Steele, *Greenock.—Patent dated May* 11, 1855.

Fig. 1.

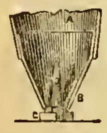
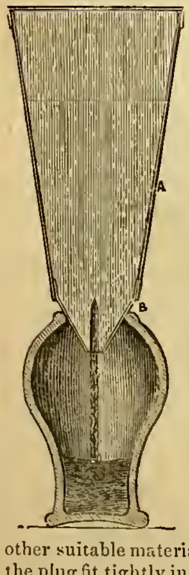


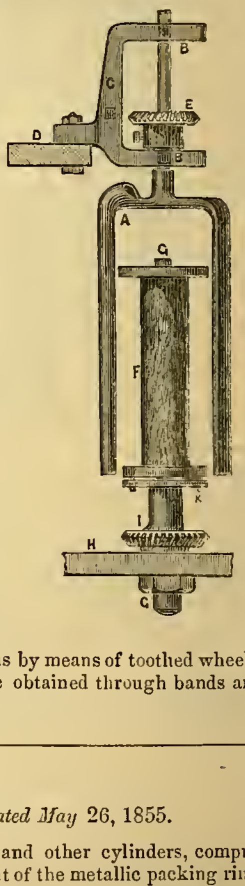
Fig. 2.



When in the refining of sugar the draining process is to be effected as at present pursued, the attendant drives a pin into the apex of the mould, so as to produce the outlet necessary for the drainage of the moisture. Now, in this old process great uncertainty of effect is produced, owing to the difficulty of properly entering the pin; and in addition to this, much loss of saccharine matter arises from the wasteful escape at the apex of the mould. In the present improved process, the drainage pins are all entered into the moulds prior to the deposition therein of the fluid sugar. The pins have broad beads or flange pieces, carrying cloth or elastic washers to fit up against the mould aperture. Hence all wasteful escape is prevented. When the drainage is to commence, the operator withdraws the pins, leaving the drainage aperture moulded as it were in the sugar. With this arrangement, not only is the process materially shortened and simplified, but the effect is rendered quite uniform throughout an entire set or range of moulds. Fig. 1 is a vertical section of the apex of a sugar mould, as fitted with the improved apex stopper, in readiness to receive the sugar to be drained. Fig. 2 is a vertical section of the mould as filled with sugar, in the act of being drained into a jar. The mould, A, into which the sugar to be drained is put, is of the usual conical shape, being in this instance made of thin metal. The apex or cone point, B, of the mould is made with an aperture, through which the sirup or uncrystallised portion of the sugar liquor or moisture escapes or drains off, this aperture being ordinarily closed by a simple plug whilst the sugar liquor is being poured into the mould. The present invention consists in closing the aperture in the apex or cone point of the mould by means of a plug, C, which is formed with a spike, D, projecting into the mould, as represented in fig. 1. A washer, E, of leather, or other suitable material, is fitted upon the plug, C, for the purpose of making the plug fit tightly into the mould aperture. The spiked plug, C, being thus fitted into the mould aperture, the sugar liquor is poured into the mould in the usual way; and when it is sufficiently solidified, the plug is withdrawn, and leaves a cavity, F, in the sugar, as shown in fig. 2. This cavity is necessary for the proper drainage of the sugar, as is well understood by the practical sugar refiner; and as any difference in the size of position of this cavity in different moulds necessarily affects the drainage action, it is obvious that this improved system, by which a uniform shape and accurate position is secured in any number of moulds, must render this portion of the refining process more certain and regular than according to the ordinary mode of forming the cavity by hand, by means of an instrument introduced into the sugar when partially solidified. It will be obvious that the spike or projection, D, may be modified in size or shape so as to produce the particular form of cavity which is found to answer best in practice.

SPINDLES AND FLYERS.

H. & R. Nightingale, *Chorley.—Patent dated January* 27, 1855.



This invention has for its object the prevention of the injurious vibration of the spindles and flyers of slubbing and roving frames, being also applicable to throstle frames, and it permits their being driven at a greater speed than has hitherto been found practicable. The accompanying figure is a side elevation of the flyer and bobbin of a roving frame. The flyer, A, in place of being attached to the spindle, is entirely separate therefrom, and rotates in suitable bearings, B, in the bracket, C, which is bolted to the roller beam, D. A skew-bevil wheel, E, is fixed to the shank of the flyer, and receives a rotatory motion from a corresponding wheel on the fly shaft, which runs from end to end of the machine. The bobbin, F, turns freely on the fixed stud or pin, G, which is fitted at its lower extremity into the lifting rail, H. A collar, I, having a skew-bevil wheel, J, cast upon it, turns freely upon the stud, G, being driven by a corresponding wheel on a longitudinal shaft working in bearings carried by the rail, H. The bobbin, F, rests with its lower flange upon the collar, I, and it is fixed thereto by a pin, K, so that it is carried round by the collar. The vertical traverse of the lifting rail during the winding on of the sliver, may be obtained by means of the mechanism ordinarily used for that purpose. The inventors do not confine themselves to the mode of driving the flyers and bobbins by means of toothed wheels, as the actuating power may obviously be obtained through bands and grooved pulleys.

PISTONS.

T. Mather, *Preston.—Patent dated May* 26, 1855.

Fig. 1.

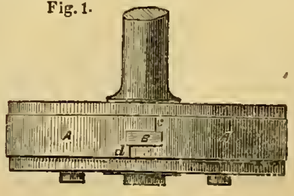
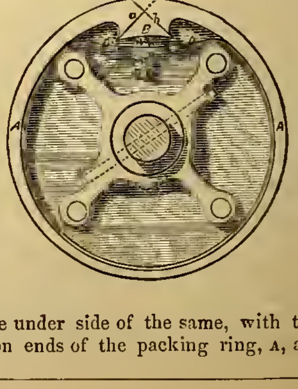


Fig. 2.



The improvement in pistons for steam and other cylinders, comprehended under this patent, refers to the joint of the metallic packing ring and is represented in the accompanying engravings; fig. 1 being a side elevation of a piston and packing ring, the latter formed with the improved joint, whilst fig. 2 is a corresponding plan of the under side of the same, with the piston cover removed. The junction ends of the packing ring, A, are made to overlap each other, being cut towards the inside in opposite oblique directions, as shown at *a b* in fig. 2, instead of being cut radially, or in a direction directly towards the centre of the piston, as is usually the case. The two junctions, *c* and *d*, seen in fig. 1, are prevented from communicating, and from thereby permitting the passage of steam, by the interposition of the outer end of the single stop or wedge-piece, B, which is passed through a recess formed between the junction edges of the ring, and which, being shaped behind to fit the oblique edges of the ring, serves to press the packing outwards in the ordinary manner, being itself acted upon by the adjustable screw, C, and spring, D. This arrangement of packing ring obviously affords a simple, effective, and durable piece of work.

REVIEWS OF NEW BOOKS.

The Elements of Practical Hydraulics: for the Use of Students in Engineering. By Samuel Downing, M.A. 8vo. Plates and Woodcuts. Pp. 124. London: Longmans. 1855.

This "Text Book for the Students in the School of Engineering, Trinity College, Dublin," has been rightly deemed by its author, the Professor of Civil Engineering in the University of Dublin, to be worth transplanting to the more voluminous and wider-spread libraries of the profession at large. That great authority, D'Aubuisson, whose "Traité d'Hydraulique a l'usage des Ingenieurs" has so long served as the very foundation of hydraulic practice all over the world, has been largely drawn upon for the earlier portion of the present work. This section, indeed, embraces two-thirds of the matter; but, in the rest, the author discusses the flow of water in artificial channels, rivers, and pipes, without D'Aubuisson's aid, introducing the formula for the uniform motion of water laid down by English engineers for themselves.

For a practical existing example of a mode of insuring a constant fluid discharge through an orifice communicating with a varying head level, Professor Downing has gone to our own pages (misquoting our title, however), giving a reduced copy of our plates of the Gorbals Water Works, supplying the southern district of Glasgow. With matter like this, he has given a practical and trustworthy character to his book, so that the working engineer will not dip into its pages in vain. The "Examples and practical applications," forming the conclusion of both sections, alone embody a mass of referential particulars of direct adaptation to the wants of the times. The following extract, which shall form the tail-piece of our notice, indicates how closely the author has carried his views to the practice of the day:—

> "The actual rate of fall adopted by engineers may be studied in the following series of examples:—
>
> "The celebrated Shawswater aqueduct or channel, which conveys water to Greenock for mill-power and supply of the town, has a fall of 4 ft. per mile throughout its length of 5 miles; it discharges 43·3 cb. ft. per sec., equal to 2600 cb. ft. per minute, the depth of water being about 1·56 ft.; bottom width, 6 ft., and slopes generally, ½ to 1.
>
> "The canal from the river Durance to Marseilles, intended for irrigation and water-power, has a fall of 2·416 ft. per mile, conveying 528 cb. ft. per sec.
>
> "The Grand Ganges Canal, now opened, the largest in the world, having a course of 898 miles, navigable throughout, and furnishing irrigation to 5,400,000 acres, has a fall of 1·5 ft. per mile, a depth of 10 ft., and a constant bottom width of 140 ft.; and is intended to convey 6,750 ft. per sec.; the slopes are not mentioned, but at 1½ to 1, the formula would give 7,316 cb. ft. The fall in this canal may, from its vast dimensions of transverse section, be considered very great, and the resulting velocity such as would ordinarily wear down the sides: in tropical countries, however, it would appear that the growth of aquatic plants, causing a great increase of resistance on the bottom and sides, is a serious evil to canal works, and necessitates a greater inclination of surface than would be required in higher latitudes.—('Italian Irrigation,' by Captain B. Smith.)
>
> "Covered channels constructed of masonry offer less resistance from the greater truth of the lines of the work, and evenness of surface of bottom and sides of channel, when well constructed, than is found in open channels excavated in the ground.
>
> "The Croton Water Works, supplying the city of New York, afford the finest modern example of water supply having this great advantage of a covered channel, so essential to the purity and low temperature of the water. The transverse section of the culvert is given, with figured dimensions, in fig. 55. The fall is 13½ inches, or 1·125 ft. per mile; the discharge is said to be 60,000,000 gallons in twenty-four hours, which gives 111·1 cb. ft. per sec.
>
> "The projected supply from Loch Katrine for the city of Glasgow is to be conveyed by a culvert or tunnel 8 ft. in diameter, and with a slope of 1 in 6,336; in crossing the intervening valleys, a cast-iron pipe, 4 ft. in diameter, is used, like an inverted siphon; the total fall from point of entry to that of delivery being at the rate of 1 in 1,000, or 5·28 ft. per mile.
>
> "The Canal de l'Ourcq, conveying water from the Ourcq to Paris, has an inclination of 0·0001056, or 33·26 ft. fall in the total length of 314,966 ft. The gauging of the river l'Ourcq showed that 106·61 cb. ft. were to be conveyed down; the projected navigation required a depth of 4·9213 ft., and it was deemed necessary to give a velocity to the current of 1·1483 ft. per sec. From these data it resulted, from the use of the complicated formula which introduced the simple power of the velocity (p. 108), and such other modifications of it as were assumed to represent every different kind of resistance, that the inclination should be 0·00005502. But the engineer, fearing the retarding effect of the weeds and plants which grow abundantly on the bottom and sides, finally adopted that named above, 0·0001056, or nearly double that given by calculation, making the fall 0·5575 ft. per mile.
>
> "The New River (as it is still called), conveying water to London from near Ware on the river Lea, is graduated to 0·25 ft. per mile, having a winding course of 39 miles; its breadth is said to be 18 ft., and depth 4 feet. The fall in this canal, intended for domestic supply, is too small, as in summer the water becomes raised in temperature from the great surface exposed in its long course, and from the slow rate of motion, which is about half a mile per hour."

Report of a Series of Experimental Observations on Two Lengths of Submarine Electric Cable, containing in the aggregate 1,125 Miles of Wire. By Wildman Whitehouse. 8vo., Pp. 23. Plates. Brighton: Wallis. 1855.

No one in our own immediate times has done more for the practical development of the electro-telegraphic system than Mr. Whitehouse. Pursuing his subject with all the ardour of a purely disinterested scientific man, his researches have resulted in contributions to our knowledge of this wonderful agent—commanding at once the attention and respect of observing men. The few pages before us—"printed for private circulation"—form the substance of a paper read before the British Association at the recent Glasgow meeting, and already noticed by us in brief.* The experiments upon such enormous lengths of telegraphic wire are interesting from that fact alone; but we shall look for something still more attractive from the same source hereafter, as, since the preparation of the essay before us, the author has had a still larger line thrown open to him. Mr. Charles Bright, the engineer of the English and Irish Magnetic Telegraph Company, has volunteered free access to the company's system of subterranean and submarine wires. These wires extend from London, by Dumfries, to Dublin, and are 660 miles long; whilst, in the aggregate, the number and length of wires laid down in connection with the main trunk, gives the opportunity, possessed by no other company, of working through a circuit wholly subterranean and submarine, amounting to 5,000 miles.

Adcock's Engineer's Pocket-Book for the Year 1856. London: Simpkin, Marshall, & Co. 1856.

Amongst the books of the season, none are more heartily welcomed by readers like ours than Mr. Adcock's annual pocket volume. The general character for condensed usefulness which the editor has secured for his work, during the many years for which it has stood, is at least sustained in the issue for 1856, whilst various judicious additions have been made to its ordinary run of matter. The tabular information, in particular, forming the latter part of the volume, is this year enriched by very many practical data, which the theoretical engineer and the operative mechanic and artificer will equally find useful in everyday pursuits.

The Metropolitan Buildings Act, and Notes of Cases, &c. By Frederick W. Laxton. Pp. 52. London: Butterworths. 1855.

The metropolitan professional man will find Mr. Laxton's little volume a most useful compendium for consultation on all matters connected with architectural law. The act is given in full, with practical annotations, and a clear chapter of references to the several sections—a list of districts and their surveyors, and an alphabetical index to the act. With this book on his desk, the architect, builder, or house proprietor, can never be at a loss for even the minutest details of the law to which modern legislation compels him to conform.

CORRESPONDENCE.

ON THE MECHANICAL EQUIVALENCE OF HEAT—THEORY OF THE EXPANSION OF STEAM AND AIR.

I am induced to offer some observations on these subjects, from noticing, in your Journal of last month, Mr. Edwards' paper on the highest temperature which has been observed in a furnace; from which he assumes, that since it is believed that equal quantities of heat produce equal power, whatever may be the substance employed, we should find that the same quantity of heat which doubles one cubic foot of air should also produce one cubic foot of steam of equal pressure; whereas, in practice, it seems, as he has stated, that above three volumes of air are produced from the same heat, from which we get only one volume of steam. In observing this, Mr. Edwards conceives that only one-third of the heat given out by the fuel is transmitted to the water, two-thirds being dissipated, or carried off by the air and lost. But from what follows, I think it will be seen, that although three cubic feet of air may be raised in temperature from 60° to 580°, and consequently in volume from 3 to 6 cubic feet, by the same quantity of heat as that required to produce one cubic foot of steam of the same pressure from water at 60°, still no greater power would be derived from this increase of three volumes of air than from one of steam.

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* Page 185, Part 92.

The power derived from steam is not the whole expansive force exerted, but the difference only of the force with which the steam expands, compared with that required for compression into and in the condenser, or expulsion into the atmosphere, minus also the power which is required to compress or force the water into the boiler; and with an air engine it is the same, the power derived is the difference of force with which the air expands at a high temperature, compared with that required for compression at a lower temperature. For instance, let as much water be put into the bottom of an open cylinder as would produce 800 cubic inches of steam at the pressure of the atmosphere, say 15 lbs.; the temperature of the cylinder being raised from 60° to 212°, a fitted piston would be raised through 800 cubic inches of space against the atmosphere; yet, under such circumstances, no useful effect would be exerted, although the steam has actually raised 1000 lbs. through one foot, as $800 \times \frac{15}{12} = 1000$; but, in this position, if the cylinder is again reduced to 60°, the pressure of the steam would be reduced from 15 lbs. to ¼ of a pound on the square inch, and in place of having below the piston 800 cubic inches of steam at 15 lbs., we would now have—not a vacuum—but 800 cubic inches of steam or vapour at a ¼ of a pound. The piston would, therefore, now return to its former position, with a force of 14¾ lbs. on the inch, through 800 inches, which would be equal to $800 \times 14\frac{3}{4} \div 12 = 983$ lbs. raised one foot. Therefore, although the steam expanded with a force of 1000 lbs. at 212°, nearly 17 lbs. must be deducted from this, as the force required for compressing into water a portion of the same steam at 60°.

Let now 800 cubic inches of air at 60° be placed under a piston in the same manner, and raised in temperature to 580°, when its volume will be doubled, the pressure being uniform; but, under these circumstances, as before, no useful work would be done until the air is again reduced to 60°, when the pressure would also be reduced to 7½ lbs.—that is, we would now have a space under the piston of 1600 inches filled with air at 7½ lbs. pressure; but the piston would only return through 800 inches, until the pressure was again 15 lbs. as before. In returning to its former position, it will, therefore, only begin to move with a force of 7½ lbs., which would gradually diminish and be reduced to almost nothing before having returned through 800 inches; although, therefore, 1000 lbs. was raised by the air in expanding from one to two volumes, the piston would only return with a force equal to 307 lbs. raised through one foot, as 693 lbs. would be required to compress the air to its original volume at 60°. While, therefore, under the circumstances given, 800 inches of steam would raise 983 lbs., 800 inches of air of the same pressure would, in expanding to two volumes, render useful an efficiency of 307 lbs. only; being less, as stated, than one-third of the power acquired from the same volume of steam. If a spring was loaded with 1000 lbs., and gradually relieved of a portion of this weight, it would uncoil itself as the burden diminished; and so, if the same quantity of air was expanded from 15 to 7½ lbs. pressure, at a uniform temperature of 60°—that is, without any rise of temperature—the force exerted by the air in expanding to a double volume would equal 693 feet pounds, and when gradually raised in temperature to 580°, 1000 lbs. is raised; the difference, or that gained by the increase of temperature, is only 307 lbs. It is then obvious, that, unless the same quantity of heat which is required to produce one volume of steam could more than double three volumes of air, the powers derived from equal quantities of heat under the circumstances shown would not be equal.

Within the last few years, as is observed by Regnault, the mechanical theory of heat has met with more favourable consideration; but an important modification has been made in the principle of Carnot. It has been assumed that heat may be transformed into mechanical work; and, reciprocally, that mechanical work may be converted into heat. According to Carnot's theory, the quantity of heat possessed by the elastic fluid at its entrance into the steam engine is found undiminished in the elastic fluid which is discharged from it, or in the condenser, the mechanical work being produced solely by the passage of heat from the boiler to the atmosphere, or condenser, in traversing the engine. According to the new theory, the whole of this quantity of heat does not remain in the state of heat; a portion disappears during the passage through the engine, and the motive work produced is, in all cases, proportioned to the quantity of heat lost. Thus, in a steam engine with or without condensation, working or not working expansively, the mechanical work is proportional to the difference between the quantity of heat which the vapour possesses at its entrance into the engine, and that which it possesses at its discharge, or at the moment when it is condensed.

Some time previous to these observations of Regnault, a series of the most ingenious and carefully-conducted experiments had been made by Joule, for the purpose of determining the quantity of power required to produce, by friction alone, a given quantity of heat, from which, after rubbing together different surfaces, agitating water, oil, and mercury, and also by expanding and compressing air with an accurately measured force, he arrived at the conclusion, that, to produce as much heat as would raise in temperature one pound of water one degree Fahrenheit, required a fall of one pound through 772 feet, say, 772 foot pounds.

Since, then, 772 foot pounds are required to raise in temperature one pound of water one degree, if this heat could be totally reconverted into power, each degree added to a pound of water should raise 772 lbs. one foot; and, taking the heat evolved by the combustion of one pound of carbon as equal to that required to raise in temperature 14,000 lbs. of water one degree, the power developed should equal $772 \times 14{,}000 =$ 10,808,000 lbs., or 48,250 tons raised one foot, being nearly the work of 5½ horses for one hour, or an engine of nearly 5½ horses' power would require only one pound of carbon an hour, whereas the best Cornish engine requires fully 2 lbs. of coal an hour per horse-power, or 11 times this quantity. Very soon after the results of Joule's experiments were made known, taking those experiments partly as the basis of his calculations, Rankine called in question the correctness of the experiments of Delaroche and Berard, with regard to the specific heat of air, and relying upon the accuracy of Joule's experiment, stated, that, in place of ·266, the true specific heat of air under constant pressure, if more accurate experiments were made, would be found to be about ·240 only. A year or two after this the correctness of Joule's experiments and Rankine's deductions were in a great measure verified.

For several years Regnault has been engaged, at the expense of the French Government, in determining the relation of different substances for caloric; and the results of his researches—the most elaborate, and undoubtedly the most accurate ever made—with regard to the specific heat of elastic fluids, were made known in 1853. The specific heat of steam, as given by Regnault, is ·475 only, or rather less than half that of an equal weight of water; and of air ·238 nearly, which differs exceedingly little from that—·240—calculated partly from Joule's experiments by Rankine; and what is no less remarkable—and which, I believe, had also been stated by Joule, although contrary to what has hitherto been taught—it was found by Regnault that the specific heat of air did not appreciably alter under any constant pressure—that is to say, the quantity of heat required to raise in temperature one pound weight of air through 100° was independent of volume; or say, whether contained in a space of one or twenty cubic feet, provided, only, that the pressure, whatever it may be, remains uniformly the same while being heated.

It is, however, well known that air cools, or absorbs heat while expanding, and evolves heat when compressed, and this absorption and evolution of heat has hitherto been attributed to the capacity of air for heat increasing and decreasing with pressure; but, according to the theory of heat being convertible into mechanical power, which is now gaining general acceptance, the heat which becomes latent, or disappears when air expands, depends upon the work done in overcoming external pressure—that is to say, if any volume of air, in expanding, raises a weight of 772 pounds one foot, or exerts and overcomes an equivalent external pressure in raising the atmosphere or otherwise, then the heat absorbed, or required to maintain a uniform temperature in the air while expanding, will equal that which would raise in temperature one pound of water one degree Fahrenheit; or if any volume of air is compressed with any external force equivalent to 772 foot pounds, the quantity of heat evolved would be the same. Since, then, the heat evolved during the compression of air is simply in proportion to the *whole force* exerted—atmospheric pressure included, if this is permitted to descend and assist in compression, as it would in the usual manner of compressing air in a cylinder, or in the action of pressing together an ordinary inflated bladder—when this force is known, so may also the quantity of heat evolved. When 800 cubic inches of air, at a pressure of 15 lbs., is compressed to half its volume, the whole force exerted would equal 693 foot pounds; the heat evolved would, therefore, equal that required to raise $\frac{693}{772}$, or nearly $\frac{9}{10}$ths of a pound of water one degree. If the external atmosphere is permitted to assist in this compression, this force which the external atmosphere will exert in following the piston through a space of 400 cubic inches, having a pressure of 15 lbs. per inch, would, of itself, equal $400 + \frac{15}{12} = 500$ foot pounds; in this operation, therefore, 193 foot pounds of mechanical force only would be expended, as $693 - 500 = 193$, while the heat evolved would be as much as could be produced by friction alone, with an expenditure of 693 foot pounds of mechanical force. Therefore, although the heat which disappears, or is evolved during the expansion or compression of air, is strictly in proportion to the *whole* force exerted, yet, at the same time, a much greater quantity of heat may be evolved in compressing air than is equivalent to the power expended; and conversely, when power is derived from the expansion of air, the heat which disappears, although strictly in proportion to the whole force exerted, is much more than can be rendered efficient. Since, then, heat disappears in proportion to the force overcome while air expands, it is obvious that a less quantity of heat will raise through an equal number of degrees, any given weight of air, at a constant volume and increasing pressure—as no weight would then be raised—than under constant pressure and increasing volume. This difference is easily arrived at. One pound weight of air, at a temperature of 60° and pressure of 14·7 lbs.,[*] will measure 22·571 cubic inches, and would be doubled in volume in adding 520° to its temperature; and, taking the specific heat of air under constant pressure at ·240, the quantity of heat necessary for this elevation of temperature would equal that required to raise 520° × ·240 = 124·8 lbs. of water one degree—say, 124·8 units of heat—and the absolute weight raised by this air while expanding to a double volume, under a uniform pressure of 14·7 lbs., would equal $22571 \times \frac{14{\cdot}7}{12} = 27{,}649$ foot pounds, which is equivalent to the force necessary for the generation of 27,649 ÷ 772 = 35·8 units of heat.

If, then, while being heated, the air had not been permitted to expand, but confined to a constant volume, although its pressure would have been doubled, no work would have been done, and this 35·8 units, which would disappear in producing expansive force, would not have been required. To have raised through an equal number of degrees in temperature the same weight of air under constant volume, would, therefore, have required only 124·8 — 35·8 = 89 units of heat; or, while equal increments of temperature, added to 520 lbs. of air under *constant pressure* and 124·8 lbs. of water, require equal quantities of heat, under *constant volume* equal quantities of heat are required to raise through equal increments of temperature 89 lbs. of water and 520 lbs. of air; or, while the specific heat of air at constant pressure is $\frac{124{\cdot}8}{520} = {\cdot}240$, that under constant volume will be $\frac{89}{520} = {\cdot}171$.

To convert a pound of water at 60° into steam at a pressure of one atmosphere, and to raise the temperature of this steam to 580°, would require 1,294 units of heat. First, to raise the water from 60° to 212° would require 152 units; second, to convert this water into steam at the same temperature, 967 units; and, next, to raise this steam in temperature 368°—that is, from 212° to 580°, would require 368 + ·475 = 175 units nearly, which together, as I have said, equals 152 + 967 + 175 = 1,294.

Then, although the volume of one pound weight of saturated steam is not yet known, it has been ascertained, with a very great degree of accuracy, that, when steam is sufficiently superheated and converted into a perfect gas, its density compared to air is ·622 nearly—that is to say, 622 lbs. of perfect steam and 1000 lbs. of air, under the same pressure and at the same temperature, are equal in volume; then one pound of air, at a pressure of 14·7 lbs. and temperature of 580°, I have stated, will measure 22,571 × 2 = 45,142 cubic inches; and one pound of steam, at the same temperature and pressure, will measure 45,142 ÷ ·622 = 72,576 cubic inches; and if this volume of steam is produced by 1294 units of heat, 124·8 units will produce about 7000 cubic inches only. While, therefore, 124·8 units of heat will double the volume of 22,571 cubic inches of air at constant pressure, the same quantity of heat will only produce 7000 cubic inches of steam, at the same temperature and pressure, from water at 60°.

If a pound of air is compressed into half its volume—say, from 15 to 30 lbs.—in a cylinder, at a uniform temperature of 60°, and discharged from this cylinder in its compressed state—that is, at a uniform pressure of 30 lbs.—under the moveable piston of a second cylinder, having a double capacity and temperature of 580°, this second cylinder would be half filled with the heated air at a pressure of 30 lbs., and if then expanded at a uniform temperature of 588° to a double volume—that is, to 4 times the volume at which it was discharged from the smaller cylinder—the pressure would be again reduced to 15 lbs., or, say in equilibrium with the atmosphere; and if now discharged into the atmosphere in this heated state, the whole heat expended in this operation would equal 174·4 units, and the power developed over and above that required for the compression of the cold air would equal 19,160 foot pounds; or that which would be required by friction alone to produce 19,160 ÷ 772 = 24·8 units of heat, or nearly $\frac{1}{7}$th of the whole heat expended would be converted into power.

In the first place, 24·8 units would be evolved while compressing into half its volume this air at a uniform temperature of 60° (if, however, this heat is not absorbed by water or other body during compression, the air will rise rapidly in temperature, and as more power would be necessary for compression, a greater quantity of heat would also be produced); next, 124·8 units would be required to raise the temperature from 60° to 580° while entering the second cylinder, under a uniform pressure of 30 lbs.; and then, to maintain this air at the same uniform temperature of 580°, while expanding to a double volume, would require 49·6 units, or precisely double that which was evolved in compressing the same air into half its volume at 60°. These 49·6 units, which disappear during expansion, are all converted into power, but half of this power is employed in compressing the cold air and reproducing heat. When, therefore, this air is discharged into the atmosphere at a temperature of 580°, 124·8 units of heat will be carried along with it. If, then, these 124·8 units of heat which is discharged along with the air into the atmosphere could be entirely stored up in some other substance, such as Stirling and Ericsson's regenerator, an engine of this description would, theoretically, convert precisely one-half of the heat expended into available power—that is, leaving friction and all other losses and difficulties out of view; but, as little useful effect would be derived from a water wheel that required to force back to its original source half the water by which it is driven, neither could any great efficiency be expected from such an engine.

I have here said that 124·8 units of heat would pass off along with the air if discharged into the atmosphere at a temperature of 580°. Now, it has already been seen that 89 units is sufficient to raise the temperature of 1 lb. of air from 60° to 580° under constant volume; but, as the air in being discharged into the atmosphere at a double volume would have to raise or displace the atmosphere to the extent of 22,571 cubic inches, 35·8 units would disappear in overcoming this external pressure; while, therefore, the air retained only 89 units, 35·8 units would disappear in doing work that would not be rendered useful.

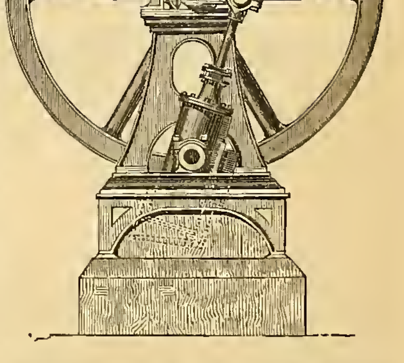
The product of the volume and pressure of a given weight of any perfect gas is a constant quantity, the temperature being uniform, whatever may be the pressure; thus, the product and volume of 800 cubic inches of air, at a pressure of 15 lbs. per inch, is $800 \times \frac{15}{12} = 1000$ lbs., and is the same as 100 cubic inches at the pressure of 15 × 8 = 120 lbs., as this is also $100 \times \frac{120}{12} = 1000$ lbs.—that is to say, is equal to 1000 lbs. raised one foot high.

I shall conclude my argument next month.

Glasgow, Dec., 1855. J. B.

STEAM ENGINES FOR LANDOWNERS.

The engine represented in my sketch is one made by Mr. Michie of Battersea Road, Nine Elms, London, of all sizes up to 12 horse power. I have one of them at work here; it has a 4½ inch cylinder, and 12 inch stroke, running at a hundred revolutions per minute. It works with remarkable smoothness, and consumes but little coal for the labour performed. Its peculiarity is, that it has no eccentric for working the slide valve, the motion for that purpose being derived from a fixed stud pin in the framing, to which is jointed a link and double lever, passing to the spindle of the slide on the side of the cylinder. Thus, the oscillation of the cylinder duly actuates the valve. With 40 pounds pressure in the boiler, it works well up to two horses power, driving the following machinery:—A 5-inch and a 9-inch centre lathe; a circular-saw table with a 16-inch saw; a grooving and rebating machine, by Furness of Liverpool; and a boring machine for slates and wood.



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[*] In every instance, in this letter, in which pressure is spoken of, it is to be understood as the absolute or total pressure—not the excess above the atmosphere. And, also, in every instance in which a unit of heat is mentioned, it is to be understood as the quantity which would be required to raise in temperature one pound of *water* one degree Fahrenheit.

This boring machine does eight different kinds of work, namely:—

Drilling slates to any guage, two holes at once, at the rate of 600 per hour.
Boring the heads of gate hurdles, doing five holes, 1¼ inch diameter by 3½ inches long, in one minute.
Boring the piles to fix the hurdles, shaping the ends of the bars to fit the hurdle heads.
Boring gate bars, seven holes in each, and the heads for the same.
Shaping the ends of the gate bars, to fit the heads and bars.

It will also bore holes in any other kind of work, up to 1½ inches by 4 or 5 inches deep.

By these five machines, all the wood-work on the estates of J. J. Farquharson is prepared. And in connection with an excellent saw, driven by one of Tuxford & Son's portable steam engines of seven horses power, all the timbers are prepared. The boring machine is an invention of my own; it works through all its phases with most satisfactory results. Mr. Michie's engine is simple, compact, and light, requiring hardly any repairing; and as it is independent of all slides and guide rods—the most troublesome parts of all direct-acting engines—it may well be classed amongst the best of the "farmer's mechanical aids." I am certain that the farmer still wants a simple and compact portable engine, and I contend that it is only to be found in the oscillating class. We have, within a short distance of each other, three high-pressure engines—a horizontal engine, 10 inch cylinder, and 18 inch stroke; a portable steeple engine, 7½ inch cylinder, 12 inch stroke, seven horses power, and the oscillator referred to; and from my daily observation, I am convinced that the oscillator does the most work in proportion to its size.

H. Childs.

Langton Cottage, Blandford, Dec., 1855.

CAPT. NORTON'S ORDNANCE—GLASS-TUBE IGNITER FOR RAILWAY SIGNALS.

I have fired an iron shell of cylindro-conoidal form, having a wooden sabot, fortified with thick pasteboard, attached to its base, from my rifle four-pounder iron cannon, cast with its bore, and *three* rifle grooves ready formed in the casting, into a chalk-butt outside the Rosherville gardens. The distance was seventy yards, and on the shell striking point-foremost, the wooden stopper was driven into the shell, thus allowing an opening for the liquid fire to pour out, had the shell been charged with it. The wedge-shaped stopper may be made of iron, so that the force of driving it in by the resistance of thick planking may *burst* the front of the shell, and thus afford a wider outflow for the liquor. This *three*-groove cannon —grooves and bearings equally divided—was cast in a very neat and perfect manner by Messrs. Glover of Drury-lane. The metal used was Stirling's toughened iron and "cold-blast." I am convinced that a rifle 68-pounder iron cannon, cast in a similar manner, would throw my rifle-shot, shell, and spinster, without fail, to the distance of four English miles, and to this matter I would respectfully and earnestly solicit the serious attention of the Minister-at-war, being fully persuaded that my patented method of casting is applicable to the heaviest, and every description of ordnance. I fire the cannon with one of my patented glass-tube igniters, coated on the inside with lucifer composition, which is placed upright in the vent; a cord, looped at its end, passes round the tube, and a pull of the cord breaks it, and by the consequent friction fires the gun. This is the waterproof igniter I use for firing my submarine shells.

In the glass-tube igniter for railway alarm signals, instead of the heads of lucifer matches, which are small slips of deal, and sometimes liable not to afford sufficient friction from their softness I now use small iron brads, covered half-way up from the heads to the points with lucifer composition, in the same manner as the matches; the hardness and sharp edges of the iron brads is sure to cause ignition by friction with the crushed glass-tube which encloses the brads. The igniter thus prepared, is also used with my percussion cartridge in blasting the stumps of large trees in clearing forest land. The tube may be enclosed in tough thin paper twisted at the open end.

John Norton.

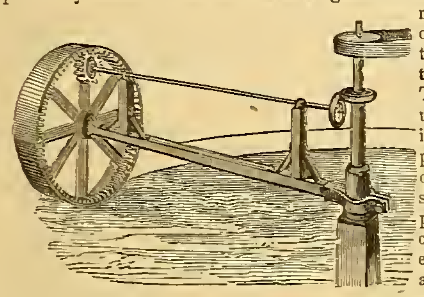
Gravesend, Dec., 1855.

MONTHLY NOTES.

The Evanescence of Paper Photographs.—We reported some time ago, that a photographic committee had been appointed to inquire into the causes of the fading of photographic pictures, and the possibility of fixing them in a durable manner. The first report of that committee has now been issued, and the framers state that they have confined themselves therein to a statement of the evidence which they have collected, as to the permanence of photographs up to this time, adding, however, some facts as to the causes of fading, but reserving the scientific part of the investigation to a future occasion. The following is the report:—*Evidence of permanence*:—The committee have unquestionable evidence of the existence of photographs which have remained unaltered for more than ten years, prepared by salting plain paper with a chloride, afterwards making it sensitive with either nitrate or ammonio-nitrate of silver, fixing with a freshly-made solution of hyposulphite of soda, and washing in water;—also of positives produced by Mr. Talbot's negative process. They have not been able to obtain evidence of photographs having been prepared at all upon albuminized paper, or coloured with a salt of gold, or fixed with "old hypo," so long ago as ten years. They have, however, ample evidence of the existence of unaltered photographs so prepared five, six, and seven years ago. They have not found that any method of printing which has been commonly followed will necessarily produce fading pictures, if certain precautions be adopted, nor have they evidence that any method which has been adopted will not produce fading pictures unless such precautions are taken.—*Causes of fading*:—The most common cause of fading has been the presence of hyposulphite of soda, left in the paper from imperfect washing after fixing. The committee think it right to state, that they have been unable to find any test to be relied upon, which can be used to detect a minute portion of hyposulphite of soda, in the presence of the other substances which are obtained by boiling photographs in distilled water and evaporating to dryness; yet they have no doubt of the truth of the above statement, from the history given of the mode of washing adopted. The continued action of sulphuretted hydrogen and water will rapidly destroy every kind of photograph; and as there are traces of this gas at all times present in the atmosphere, and occasionally in a London atmosphere very evident traces, it appears reasonable to suppose, that what is effected rapidly in the laboratory with a strong solution of the gas, will take place also slowly but surely in the presence of moisture, by the action of the very minute portion in the atmosphere. The committee find that there is no known method of producing pictures which will remain unaltered under the continued action of moisture and the atmosphere in London. They find that pictures may be exposed to dry sulphuretted hydrogen gas for some time with comparatively little alteration, and that pictures in the coloration of which gold has been used, are acted upon by the gas, whether dry or in solution, less rapidly than any others. They also find that some pictures which have remained unaltered for years, kept in dry places, have rapidly faded when exposed in a moist atmosphere. Hence it appears that the most ordinary cause of fading may be traced to the presence of sulphur, the source of which may be intrinsic from hyposulphite left in the print, or extrinsic from the atmosphere, and in either case the action is much more rapid in the presence of moisture.—*Mode of mounting Photographs*:—The committee find that taking equal weights, dried at a temperature of 212°, of the three substances most frequently used, viz., gelatine, gum, and paste, the latter attracts nearly twice as much moisture as either of the former; and as in practice a much smaller weight of gelatine is used than of gum, gelatine appears to be the best medium of these three, and the committee have evidence of fading having in some cases been produced by the use of paste. In illustration of some of the circumstances alluded to above, the committee think it well to mention some instances of prints at present in their possession. Out of several prepared together in 1844, three only are unaltered, and these were varnished soon after their preparation with copal varnish. Half of another print of the same date was varnished, and the other half left; the unvarnished half has faded, the varnished remains unaltered. Three pictures were prepared in 1846, all at the same time, with the same treatment; when finished, one was kept unmounted, the other two were mounted with flour-paste at the same time, one of these latter having been first coated with Canada balsam; at present the unmounted one and the one protected with the balsam are unchanged, whereas the other has faded. A picture prepared in 1846 was so exposed that the lower part of it became wetted with rain; at present the part so wetted has faded, while the rest of it remains unaltered. Several pictures were prepared and mounted about ten years ago, and kept in a dry room for about three years without any change, after which they were placed in a very damp situation, and then faded decidedly in a few months. The committee propose very shortly to actually test the durability of the various modes of printing, by exposing pictures to different treatment, and they have been fortunate enough to obtain a grant of space for this purpose from the Crystal Palace Company. The committee make the following suggestions, arising out of the above report:—1. That the greatest care should be bestowed upon the washing of the prints after the use of hyposulphite of soda, and for this purpose hot water is very much better than cold. 2. The majority of the committee think that gold, in some form, should be used in the preparation of pictures, although every variety of tint may be obtained without it. 3. That photographs be kept dry. 4. That trials be made of substances likely to protect the prints from air and moisture, such as caoutchouc, gutta percha, wax, and the different varnishes.—Philip H. Delamotte, Hugh W. Diamond, T. Frederick Hardwich, T. A. Malone, John Percy, Henry Pollock, George Shadbolt.

Davidson's Floating Breakwater.—The ingenious floating breakwater invented by Mr. Davidson of Edinburgh, and already engraved by us, as *in situ*, at page 198, vol. 7, shows itself, after further consideration, to be a most effective and yet inexpensive contrivance for stilling the troubled waters of the deep. Our readers may recollect that it consists of a species of open raft, large enough to cover a series of waves, and floating at the average level of the water. It can be made to answer either for a present storm, a "ground swell," or a combination of the two. That soothing rafts on this principle will subdue the sea on a scale large enough for harbours of refuge is pretty clear, from the fact that nature produces breakwaters by the aid of means less complete, as is seen on the sea-board of Newfoundland, in the fields of broken ice, where the shipping take refuge during storms; also in the South Seas, where the weeds grow to such a size and quantity, as to smooth the largest waves, and become a shelter for ships. Neither the fields of ice nor the weeds are so well adapted for the purpose as these stiff rafts. The ice and weeds rise and fall with the wave; the rafts remain at the middle of the wave. Being held there, and extending over a great number of waves, their great weight preventing them from rising, their equally great buoyancy preventing them from sinking, they stop the water there, which is its line of rest, and to where all its powers of motion are tending; the weight of the water, aided by the force of the wind, forcing that portion of the wave that is above the raft downward in every direction; and the force of the wind, and the weight of the whole height of the wave, forcing that portion of the water in the hollow of the wave upwards to the raft, where it stops, and passes off at the other side smooth water. Such breakwaters have many advantages over stone structures. They can be moored where no stone can be placed, and they are much cheaper than any fixed wall of the kind. The stone breakwater at Plymouth cost six millions sterling, and a single storm damaged it to the extent of £100,000. In looking at an invention of this kind, we must keep in mind that in one day we lately lost nearly a thousand lives and a million sterling in the Black Sea; and that upwards of a thousand lives, and nearly a thousand ships and cargoes, are annually lost on the British shores.

Horse Power Gear for Driving Machinery.—The annexed perspective figure represents an ingenious American arrangement for applying horse power for driving thrashing and grinding mills, and other machinery of small extent. Its peculiarity consists in the use of a broad ground wheel or pulley, which runs loose upon a journal on the extreme outer end of the main horizontal lever, just inside the point to which the horse is attached. This ground wheel is toothed upon its inner edge, and this internal wheel drives a spur pinion which is fast upon the outer end of a light horizontal shaft, carried in bearings on pillars set upon the upper side of the main lever. The inner end of the pinion shaft carries a bevil pinion in gear with a corresponding pinion fast on the main vertical shaft. The main lever turns loosely upon this shaft as a centre; and, as the horse goes round its circular path, the ground wheel rolls over the earth, and of course communicates a rapid rotatory motion to the main vertical shaft, which is supported in a deep journal in a central stationary pillar. This arrangement is well suited for high speeds, whilst all its parts are simple and accessible.



Permanent Liquid Glue.—A good fluid glue, ready at all times for instant use without any preliminary preparation, is one of the most useful articles of stock with which the workshop can be furnished. To make such a glue, all that is necessary is to melt three pounds of glue in a quart of water, and then drop in gradually a small quantity of nitric acid. When this ingredient is added, the mixture is to be removed from the fire and allowed to cool. Glue so prepared has been kept in an open bottle for two years, still ready for use on the instant.

Marine Memoranda.—Progress of Screw Propulsion.—The dimensions of the large wrought-iron details of the great combined screw and paddle steamer building at Millwall are interesting, as affording data for arriving at something like a true conception of the scale on which this giant of the waters is being constructed. Messrs. Fulton & Neilson, of the Lancefield Forge, Glasgow, have made, or are making, the following parts for her:—

One intermediate shaft, 21½ feet long, 26 inches diameter.
Two paddle shafts, 37½ feet long, 24¾ inches diameter.
Two cranks, 7 feet 'tween centres, and 21 inches thick.
Propeller shaft, 47 feet long, and 24⅜ inches diameter.
Three friction straps, 10 feet inside diameter, 14½ inches thick;
besides columns, covers, and other parts.

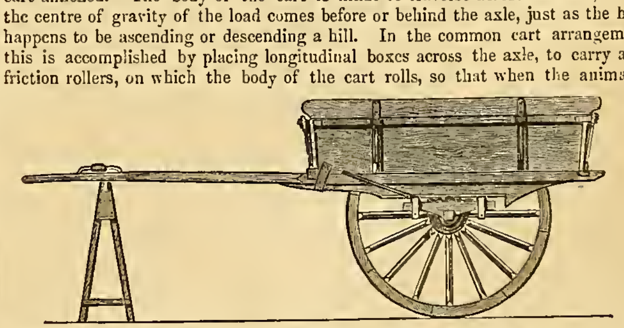
The forging of the intermediate shaft occupies six months. It is 29 tons in weight, and may well be considered to be one of the finest specimens of forging ever produced. The paddle shafts are about 20 tons each; and the cranks are 7 tons 4 cwt. each. The propeller shaft weighs 35 tons, the heaviest piece of work ever turned out of any workshop. When fitted in its place, it will be connected with nine other shafts, each 25 feet long, and 24¾ inches diameter; and including couplings, this combination of shafting will weigh 290 tons. The friction straps are 10 tons each. The vessel herself seems to be fast approaching her launching day, and formal preparations, on a correspondingly large scale, have been made in the Mersey at Liverpool for her reception in that port. She will carry eight jolly boats, each of which will be a miniature screw steamer. But, greatest curiosity of all, the steamer herself is to be steered by a small engine.

Having canals ready made by our ancestors to our hands, it has often been proposed to turn them to better account than at present, by adapting screw steamers to them. Practical attempts of this kind are nothing new; but the destructive wash upon the banks, and the expense, weight, and complexity of the machine-crowded boats, have hitherto retarded the progress of the movement. Mr. Rawcliffe, the colliery agent in Preston of the Earl of Balcarres, has now successfully awakened the dormant scheme of canal screw steamers, for the conveyance of Lancashire coal between Preston and Kendal. He has got a screw boat of 20 horse-power in regular work. The engine has two 8-inch cylinders placed in one boat, four other boats being hooked on behind to form a train. The quantity of coal conveyed each trip is about 200 tons, loaded in the five boats, and a speed of two miles per hour is maintained. This speed might be increased, we believe, did the depth of water in the canal permit it; but, at present, if a greater speed is attempted, a swell of water is created in front of the boat, reducing the level of the canal at the bows so much as to cause the boat to scrape the bottom. By the old system, one horse dragged a boat of from forty to forty-five tons burthen at a rate of one mile and a quarter per hour. Lately, an extra new iron boat, capable of carrying fifty-seven tons, has been attached to those previously towed by steam (making the five now used), and with this very large additional weight, it has only made a difference in speed of three quarters of an hour per day, and the addition of this extra weight has consequently retarded the boats almost imperceptibly. A new iron boat has just been built for the same purpose, to be worked by steam power. She is a twin paddle boat. Two boats, of sixty feet long each, have one central paddle working between them, and this arrangement prevents the usual swell which the ordinary river paddle boats create. This steamer has already been tried on the canal, and is found to require less power to do the same work than the screw boat alluded to above. These experiments, combined with the substitution of iron for wood in the construction of the boats, open quite a new feature in the history of canal navigation, and must be highly satisfactory to Mr. Rawcliffe, who, we believe, was the first to suggest and to make trial of them.

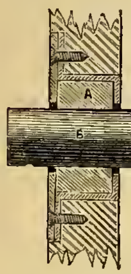
To compete with the Leeds Railways, the Aird and Calder Navigation Company has also started the screw steamer system on the inland waters under its charge. Two iron screws are now running between Leeds and Goole, and a third is in preparation, so as to supply a more efficient daily service between Leeds and Hull. The Yorkshire boats resemble the old fly-boats in build, but are shorter and bluffer. The engines are 10 horses power, of the locomotive class, fixed far forward. Each boat carries 60 tons, and acts as a tug for three others, carrying from 30 to 40 tons of merchandise.

Australian steaming has most signally failed, and moderate sailing ships have fairly beaten the steamers out of the field. The triumph of canvas over the boiler in this long voyage has been complete. It is believed, however, that the average voyage to Australia may be shortened by at least 10 days by constructing ships on the most approved clipper-models, making them inferior to none for their sailing qualities; and by fitting them with the auxiliary screw, with just sufficient power to carry them out of or into port, and eight knots at times when, owing to calms or variable winds, they would be making to keep them moving at a speed of six or little or no progress. The new iron ship *Royal Charter*, recently launched on the Dee, and built for the Australian Screw Steamship Company, has been especially constructed under this principle, which a two days' trial trip has stamped with undoubted success. She is a vessel of unusual magnitude, being of 3,000 tons burden, and having an extreme length of 320 feet, with a breadth of beam of 41 feet, depth 26 feet 6 inches; while she is rigged with double topsails throughout, her spread of canvas being no less than 15,000 yards. Her steam-power is extremely small compared with the colossal proportions of the vessel, her engines being only 200 horse-power, nominal, with a two-blade screw of 13 inches pitch and 14 inches diameter. She steamed out of the river a little before noon. On getting over the bar the engines were put on full speed, and she went steadily and gracefully through the water at the rate of 9 knots an hour, on a pressure of 13½ lbs., the engines making 75 revolutions per minute. The trial was, therefore, considered to have proved more successful than had been anticipated as far as the screw was concerned, and it had been the intention to proceed the same day under canvas alone, but owing to the prevalence of heavy fog it was impossible to do so, and she lay quietly off the Bell buoy during the night. Morning brought with it a clear day, and a light breeze springing up, no time was lost in hoisting the screw and making all sail. Notwithstanding the stiffness of new ropes, coupled with the fact that she was sailing somewhat close to the wind, she bowled beautifully along at the rate of 13½ knots, leaving no doubt in the minds of the practical men on board, that under a stiff breeze she will easily accomplish 17 or 18 knots.

Murray's Self-Adjusting Cart Brake.—A simple brake, which should simultaneously relieve the weight on the horse's back, in carts, dog-carts, and other two-wheeled vehicles, and put a drag upon the vehicle's motion, has long been an acknowledged want. Mr. Thomas Murray of Ellenford, Dunse, has satisfactorily attempted to supply this want in the manner set forth in our engraving of the cart annexed. The body of the cart is made to traverse across the axle, so that the centre of gravity of the load comes before or behind the axle, just as the horse happens to be ascending or descending a hill. In the common cart arrangement, this is accomplished by placing longitudinal boxes across the axle, to carry anti-friction rollers, on which the body of the cart rolls, so that when the animal is pulling, the vehicle is in its usual position; but, when holding back, the wheels and axle come forward, when the peripheries of the wheels come in contact with the brake blocks set upon the cart body before the wheels. The wheels can of course be locked in their places when it is desirable to push the cart back. Our sketch shows the cart with one wheel removed to expose the shifting details. The long lever in front is for putting the brake out of action as required, by the aid of small ratchet wheels, which place bolts before each roller box. The contrivance is



the same in the case of a dog-cart, a drawing of which we have before us, and in a gig or other carriage of the genus. Such an apparatus as this deserves notice, were it only with a view to the relief of the poor overburdened cart-horses that we every day see going up and down steep hills indiscriminately with their loads totally unadjusted, and without the slightest means of retardation when the cart's momentum threatens to crush the animal.



DALTON'S SOCKET BUSH FOR BLOCK SHEAVES.—Messrs. Dalton, the mast-makers of Ratcliff, London, have introduced a new composite socket bush for sheaves, wherein the actual bearing part is a steel socket supported by a brass body. Our engraving represents the new bush in section. A is the steel socket piece, bored to fit the sheave pin, B, whilst it is turned true externally to fit with the brass box let into the wood of the sheave. The socket being quite loose, two motions may ensue in working, as the steel socket can run upon the pin, and the brass box upon the periphery of the socket.

FERRIER'S SELF-UNFOLDING BOOK INDEX.—For works of constant reference, the best initial "contents," or terminal "index," furnishes but an inconvenient and tedious means of arriving at the parts which the reader happens to wish to investigate. The internal index pages are first to be found, and themselves turned over until the locality of the directing finger-post is discovered; then, the index being at quite a different part of the volume from the actual pages coming under perusal, the examiner has to quit the reference sheet, and go to the indicated quarter. All this trouble is saved by a very ingenious contrivance of Mr. David Ferrier, a bookseller in Edinburgh. He indexes his books externally, so that, when the volume is opened, all the references are clearly displayed in such a manner that, where the guide is, there is the object also. We have before us a handsome bible indexed in this way, so that we are enabled to speak of the merits of the invention with the voice of authority. All the books or divisions of the bible are lettered upon the two right and left edges of the leaves, the printing being done when the edges are at a slope, as when the volume is opened at the centre. Hence, when the book is shut, the edges being gilt, hardly a vestige of the references is visible. When opened, the whole index at once springs into a broad and legible existence, visible to the dimmest eyes; each reference being upon the edges of the very leaves whereon the matter stated by the index is printed, the reader has merely to open the leaves at the proper heading to find his fingers upon the information searched for. The index commences at the upper left-hand corner of the volume, where, in the present instance, "Genesis" is printed in broad black characters, running in line with the edges of the leaves. This is followed higher up in the leaves with "Exodus" in red, and so on over the whole of the edges. In these larger divisions of the volume, the lettering is just deep enough to cover the exact number of leaves taken up by the subjects referred to; hence, a little practice enables the reader to come directly upon the very chapter he wants. In the smaller divisions, where the leaves are too few in number to allow of this system being followed out, the heads of the letters indicate the commencement of the division, and an inclined line at the end of the word runs in and upon the commencing page, to catch the eye as the leaves spring from under the thumb in turning over. This index is obviously particularly applicable to all works of reference, saving, as it does, so much drudging labour to the literary and scientific searcher.

THE NEW METAL SILICIUM.—No sooner has the scientific world got its hands full of the recently discovered aluminium, than we hear of something in the same way more curious still—this is the discovery of silicium by M. Junot, a French philosopher. "If one were to declare at once, and without any preamble," says M. Plee, a brother scientist, "that paving-stones were productors of a metal scarcely in any way distinguishable from silver; that saucepans, plates, forks, and spoons, were to be got out of a block of freestone, one should probably be unmercifully laughed at—yet such is the case; the pavé does contain metal, as beet-roots contain alcohol and sugar—nothing can be more true." M. Plee follows up his assertion by the ensuing curious details:—"Take a thick lump of freestone or quartzeous silex; reduce it to powder; mix this silex when pulverized with a sufficient quantity of alkali; fuse it—you will obtain a soluble glass that you can dissolve so as to precipitate the silicium it contains in the shape of a jelly. You then take this last product and have it filtered, then redissolved a second time in a cyanurated lixivium, so as to produce a compound cyanuret. This operation will give you a fluid, whence there then only remains to extract the metal called silicium. Plunge into this liquid your utensils, whether of copper, zinc, tin, or lead; bring the electric process to bear upon them properly, and they will instantly be covered with the adhering plating of silicium, which is white as silver, and attains to the highest degree of lustre under the polisher's hand." M. Charles Junot is the industrious man who has invented this new metal, and has, according to the account given by M. Plee, spent years in indefatigable research; nor does this silicium appear to be the only substitute for silver he has discovered—two or three others are mentioned by M. Plee. This silicium, however, seems to be so hard to distinguish from silver, that a learned French chemist has already presented to the Academy of Sciences a report on the necessity of devising fresh methods of analysis, in order to distinguish between the two metals, which is which. Other chemists have other processes for the reduction of silicium, and all are setting to work at it. It is, therefore, to be expected that a complete transmutation will be effected. We shall draw aluminium from clay; from freestone, from silex, and from sand we shall extract silicium; these metals, given up to industry and the arts may replace silver for domestic purposes, and silver may be thus entirely restored to monetary circulation.

ON THE SUPPOSED INFLUENCE OF THE HOT-BLAST IN AUGMENTING THE QUANTITY OF PHOSPHORUS IN PIG-IRON. BY DR. DAVID S. PRICE, AND E. CHAMBERS NICHOLSON.—The employment of the hot-blast in the smelting of iron is admitted to occasion the production of pig-iron of inferior quality, that is to say, contaminated with larger amounts of foreign elements than that smelted with cold-blast. In the present communication it is not our intention to enter upon the discussion of this subject generally, as we intend reserving this for a future communication, but to limit our remarks to the consideration of the supposed influence of the hot-blast in augmenting the quantity of phosphorus, an element of almost constant occurrence in pig-iron, and to the presence of which, in bar-iron, the peculiar property of the metal known as *cold shortness* is attributed. In a paper published in the Quarterly Journal of the Chemical Society,[*] and also in one read before the British Association in 1849,[†] by Mr. Wrightson, several analyses of cast-iron, the produce of Staffordshire furnaces worked by hot, warm, and cold blast, are given to prove that a larger amount of phosphoric acid is reduced when hot-blast is employed. The increase in the per centage of phosphorus in the iron smelted with hot over that with cold blast, is exhibited in the following series of Mr. Wrightson's results:—

	1.	2.	3.	4.	5.	6.	7.	8.
Hot-blast, ...	0·51	0·55	0 50	0·71	0·54	......	0·07	0·40
Cold-blast, ...	0 47	0·41	0·31	0·20	0·21	0·36	0·03	0·36
Increase of Phos. in hot-blast,	0·04	0·14	0·19	0·51	0·33	......	0·04	0·04

The ores from which the iron was smelted were also analysed, and found to contain the following per centages of phosphoric acid:—

Binds.	Blue flats.	Penny earth.	Gubbin.	White ironstone.	White free.	Black free.
traces.	traces.	1·00	0·32	0·95	0·90	trace.

The increase in the amount of phosphorus indicated in the above table as occurring in hot-blast iron, does not, in the absence of a knowledge of the relative quantities of the respective ores employed, which vary as much as 1 per cent. in the quantity of phosphoric acid which they contain, and also of an examination of the blast-furnace slag produced, appear to afford sufficient proof in support of this opinion. Karsten,[‡] in speaking of bog-iron ore, says that, when smelted, the whole of the phosphate of iron is reduced to the state of phosphide, and absorbed by the iron. Berthier,[‖] from experiments conducted on a small scale, does not coincide with this view, and considers that the difficulty of detecting small quantities of phosphoric acid must account for its not appearing amongst the constituents in the various analyses of blast-furnace slags, which he has described in his work. From experiments made by assaying pure hæmatite with variable per centages of phosphate of lime[§] and suitable proportions of flux and charcoal, we have, by analysing the buttons of metal and slags obtained, taking care to select those only in which the operation was perfect, that is to say, in which a colourless slag and graphitous button were produced, also corroborated Berthier's results, as will be apparent from the following table:—

Pure peroxide of iron.	Phosphate of lime.	Flux.	Coke.	Per centage of phosphorus in button.	
				Calculated.	Found.
grms.	grms.	grms.	grms.		
1. 10·0	0 25	10·0	2·25	0·60	0·56
2. 10·0	0·75	10·0	2·25	1·83	1·60
3. 10·0	2·50	10·0	2·50	6·20	2·60
4. 10·0	5·00	10·0	2·50	12·60	6·00

In the assay of ores, and also of scoriæ from forge and mill furnaces, which contains a large amount of phosphoric acid, results widely different to the foregoing were arrived at. The following, selected from a great number of experiments, are marked illustrations of this:—

		Lime.	Coke.	Flux.	Per centage of phosphorus in button.	
					Calculated.	Found.
	grms.	grms.	grms.	grms.		
5. Welch black-band, ordinary quality—calcined, ...	10·0	3·5.	1 75	......	0·82	0·81
6. Argillaceous iron ore—calcined, very rich in phosphoric acid, ...	10·0	1·5	1·20	......	6·60	6·41
7. Brown hæmatite, also rich in phosphoric acid, ...	10·0	......	......	10·0	6·90	6·70
8. Scoria from puddling furnace,	10·0	......	2·0	10·0	13·6	12·5
9. Scoria from balling furnace,...	10·0	. ....	2·0	10·0	2·27	2·25

The time occupied in performing the assays, and the furnace conditions under which they were conducted, were about the same in all cases. Where flux was employed, it consisted of two parts of clay-shale and one part of lime. It is necessary to state, that the phosphoric acid in the ores above cited was in combination with lime. In the cinders it existed as phosphate of iron. In experiments Nos. 1 and 2, it will be seen that the quantity of phosphorus found agrees pretty well with the theoretical amount, whilst in 3 and 4 it falls considerably short. That this is owing to the length of time during which the reduction process is carried on, we have no doubt, as we have frequently repeated the assays with the same proportions, and have found the amount of phosphorus in the button to vary considerably, never having succeeded in obtaining more than four-fifths of the total quantity. If, however, the cementation were prolonged for a sufficient length of time, it is very probable that the whole of the phosphoric acid would be reduced. We have undertaken many experiments upon the large scale with the view of deciding this point. For this purpose we have determined the amount of phosphorus in iron that had been smelted from argillaceous ores by cold-blast, and by a blast heated to 600° F. The following are the results:—

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[*] Vol. i. p. 330.

[†] Chem. Gaz., vol. vii. p. 478.

[‡] *Handbuch der Eisenhüttenkunde*, vol. ii. sect. 368. Berlin, 1841.

[‖] *Traité des Essais par la Voie sèche*, vol. ii. p. 262.

[§] The amount of phosphoric acid in the phosphate of lime was previously determined.

	I.	II.	III.	IV.
Hot-blast,	0·74	0·68	0·71	0·58
	V.	VI.	VII.	VIII.*
Cold-blast,	0·81	0·62	0·68	0·63

The iron in both cases was what is known as good No. 2 foundry pig. In two instances it will be seen that the per centage of phosphorus is higher in the cold-blast iron than in the hot; but the difference in these and in the other two is so slight, that it may fairly be attributed to the variations in the composition of the ore. The slags produced simultaneously with four of the above irons were examined for phosphoric acid by the usual methods, as well as by molybdate of ammonia; and it was only by the latter reagent that we are able to find minute traces. We append the analyses of the slags:—

	I.	II.	V.	VI.
Silicic acid,	39·95	40·20	41·64	42·94
Alumina,	17·41	16·45	13·20	16·29
Lime,	29·64	30·00	35·91	31·10
Magnesia,	6·47	7·29	4·21	4·16
Protoxide of iron,	0·24	0·57	0·11	0·34
Protoxide of manganese,	0·91	0·84	0·74	0·51
Sulphide of calcium,	3·60	2·71	2·19	2·16
Alkalies,	1·46	1·30	1·70	1·87
Phosphoric acid,	trace	trace	trace	trace
Loss,	0·32	0·64	0·30	0·63
	100·00	100·00	100·00	100·00

As far as our experience enables us to judge, we incline to the opinion, that when the process of reduction is complete, or nearly so, that is to say, when no oxide of iron or small quantities only pass off with the slag, that then the whole of the phosphoric acid is reduced, and the phosphorus absorbed by the iron independently of the temperature of the blast. The analyses above given prove such to be the case with the iron smelted from the ores ordinarily employed in this country, in which the amount of phosphoric acid seldom exceeds 1 per cent. With ores and scoriæ containing large amounts of phosphoric acid, we have also had opportunities of proving that when smelted with hot-blast, all the phosphoric acid is reduced, and the phosphorus absorbed by the iron; this we have found to be the case with ores containing from 2 to 3 per cent. of phosphoric acid, and with scoriæ with as much as from 8 to 10 per cent.; but we have not had an opportunity of examining a product smelted with cold-blast from similar materials. The following exhibits the per centage of phosphorus, (IX.) in gray pig-iron smelted with hot-blast from pisolitic iron ore, (X.) of gray pig-iron smelted with hot-blast from puddling furnace scoriæ and clay-shale:—

IX.	X.
2·56	6·94

The slags respectively made with these products had the following composition:—

	IX.	X.
Silicic acid,	45 64	41·11
Alumina,	10·84	9·46
Lime,	35·01	37·90
Magnesia,	3·16	2·11
Protoxide of iron,	0·71	0·39
Protoxide of manganese,	trace	1·61
Sulphide of calcium,	3·30	6·41
Alkalies,	0·82	0·71
Phosphoric acid,	trace	trace
Loss,	0·52	0·30
	100·00	100·00

Phosphoric acid is present in blast-furnace slags when white iron is being smelted, that is, when the slag contains appreciable quantities of protoxide of iron, as will be seen by the following analyses:—

	XI.	XII.
Silicic acid,	41·11	37·84
Alumina,	13·45	13·20
Lime,	29 82	20·68
Magnesia,	4·75	2·93
Protoxide of iron,	6·44	20·83
Protoxide of manganese,	0 66	0·80
Alkalies,	1·84	1·08
Sulphide of calcium,	1·34	0·87
Phosphoric acid,	0·15	1·77
Loss,	0·44	0·05
	100·00	100·00

No. XI. is that of a slag resembling black bottle-glass in appearance, and from its liquidity when melted is termed by the workmen a *scouring slag*. It was from argillaceous ore. No. XII. from pisolitic ore when the working of the furnaces was much deranged. This slag was exceedingly heavy, of a pitch-black colour, with the surface of the blocks in the *tap wagons* of the dull, dark-red, bronze-like aspect characteristic of very bad furnace slags. From these results we must regard the ore as being melted up (not smelted) and flowing away with the slags, although in very different degrees in the two examples given. The analyses of crystalline slags by Percy and D. Forbes,* in all of which phosphoric acid was sought, lead to the same inference, phosphoric acid having been discovered and estimated in only one instance, and that in a slag similar to No. XI. It contained protoxide of iron 4·04, and phosphoric acid 0·19. In conclusion, we will briefly recapitulate the results of our experiments. 1st, That in assaying ores, all the phosphorus of the phosphates will be found in the button. 2nd, That when the ordinary iron ores, such as the argillaceous ores, black bands, hæmatites, &c. are smelted, the iron produced, if it be gray, will contain all the phosphorus of the ore, whether the furnace be driven with hot or cold-blast. Lastly, That the slag may contain phosphoric acid in determinable quantity when white iron is being smelted.—*Philosophical Magazine.*

SMOOTH-CUTTING BORING TOOLS.—The microscopical examination of some wood-boring insects, by Mr. Ransom Cook, an American gentleman, has led the ingenious observer to imitate the beautiful boring apparatus of nature in an artificial perforator. The smooth and excellent bore of the insects is said to be rivalled by Mr. Cook's tools, of which we show five several views. The improvement consists in giving the lips or cutting edges a carved or gouge shape at their extremities, as in figs. 1 and 3, as also in the under-cutting or back-sloping of those edges, as in figs. 2 and 4—between A and B—in order to give these parts a drawing movement in cutting. The body of the borer may be forged to any of the existing shapes, but the new cutting edges are best adapted for the twist or screw auger and the centre bit. In drawing or plating for the screw auger with edges on this plan, the extreme or cutting end should be left about square, and thicker than for the ordinary lips. In hammering out the lips before turning them, they should be extended from the screw or centre farther than for right angular lips. These lips should also be hammered so as to have some projection downwards, that is, project from the handle end, somewhat in the form of a swallow's tail. Being thus forged, the lips may be turned nearly or quite in the form shown in figure 1, in case the boring implement is designed to work with the greatest ease; but when a greater smoothness is essential in the hole to be bored with the instrument, the lips may be turned in the form of figure 3; while for the purpose of boring endwise of the wood, the auger and lips should have the form given in figure 5. After the hammer-work is finished, the lips, except those for boring endwise, are to be filed or dressed with the under back slope, as shown in figures 2 and 4, from A to B. No particular angle is essential in this slope, but the augers seem to work best and easiest when the slope is at about 45 degrees from the body of the auger. These implements are then to be tempered, finished, and used in the same manner as the ordinary kinds. For boring endwise, the lips should have the upper back slope, as shown in figure 5, from A to B. These boring implements will be found to cut so much easier than those now in use, that they require much less stock on their bodies, and but a small screw to hold them to the wood. The cutting action of these tools seems to be most perfect, as large holes can be bored by them close up to the edge of extremely thin wood of any kind without splitting.

Fig. 1.

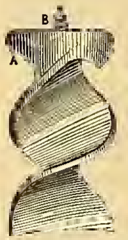


Fig. 2

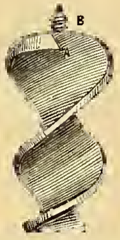


Fig. 3.

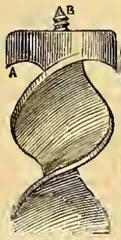


Fig. 4.

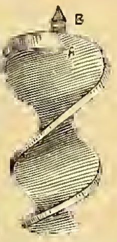
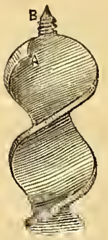


Fig. 5.



DUNN'S DUPLICATE RETORT STEAM BOILER.—Messrs. Dunn, Hattersly, & Co., of the Windsor Bridge Iron Works, Manchester, have just introduced a novel form of boiler by a public experimental test at their establishment. The boiler is composed of a series of nine cylinders or retorts, 10ft. long and 19in. in diameter, of $\frac{1}{4}$-inch wrought-iron Staffordshire plates; the cylinders have strong cast-iron ends, and are connected with each other at both extremities, the one for the water supply and the other for the discharge steam-pipes; the ends also form the man-holes. The advantages claimed for the invention are, that from the simplicity of construction the boilers can be made at a low cost, that the small size of the cylinders gives them immense strength, that any one tube or portion can be replaced from time to time, or the whole be enlarged, by placing more cylinders side by side, joining the whole into a continuous, corrugated, flat-bottomed boiler; and, lastly, the extreme portability of the boiler, a point which those who have had to encounter such difficulties, as having to dig down a roadway two or three feet in order to get one of the large-sized steam boilers under an archway, or have had to drive teams of from 20 to 30 horses in order to ascend a hill-side, will not be slow to appreciate. The experiments were conducted upon a single cylinder, such as is used in the construction of the new boiler. It had previously been tested up to a pressure of

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* These correspond with the per centage amounts of phosphorus calculated from the analyses of the ores that the pig-iron should contain, if all the phosphoric acid were reduced.

* British Association Report, 1846; and Chem. Gaz. vol. v. p. 29.

300lb. upon the square inch, and it was determined to test it up to the bursting point, by means of hydrostatic pressure. The boiler was fitted with a steam pressure index, which, however, would only mark up to a pressure of 300lb., and in addition a steelyard was fixed over the safety valve, by means of which the pressure above that point was indicated. The boiler bore the test, without any apparent alteration, up to 280lb. pressure, when the water began to ooze out of the rivet holes, and the escape subsequently increased so much, that it was found necessary to supply a force pump of larger diameter to the hydrostatic apparatus, after which the water injected exceeded the escape, so that a pressure of about 500lb. upon the square inch was obtained, at which point there were minute jets of water from nearly every rivet hole, and a considerable jet upon the under side of the boiler. The pressure, however, was forced up still further, to 525lb. on the square inch, when the boiler burst with a smart report; a long horizontal rent of between two and three feet in length being made on the side of the boiler, along a course in a line with the rivets. The escape water was dashed with considerable force into the faces of several of the scientific spectators of the experiment, which was considered on all hands to have been a highly satisfactory one.

A WATT STATUE FOR MANCHESTER.—Manchester is at length about to follow the example of Glasgow, in setting up for itself a statue of James Watt. The fact that this recognition of services is but now being seriously discussed, will come with somewhat of a shock to the feelings of those who have all along been ignorant of so plain a want in industrial Manchester, the very atmosphere of steam engines, as a Watt statue. Manchester, liberal to excess in her tokens of substantial regard for most men who have deserved well at her hands, has been eccentrically remiss in this especial instance, but the movement now making is expected to speedily wipe away the reproach. Like the statue at Glasgow, the one for Manchester is intended to be a copy of Chantrey's fine work in Westminster Abbey. It is to be placed in the large space in front of the Infirmary, where Wellington, Peel, and Dalton, have already found a fitting home. The meeting just held on the subject originated in a suggestion thrown out by the Manchester Literary and Philosophical Society. It was attended by many of the leading men of the locality, and an aggregate subscription of £240 was announced on the occasion.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded July 18.

1609. Théophile L. M. Riot and Sylvain G. P. Dehais, Paris—Improvements in the treatment of silk.

Recorded July 28.

1715. Charles E. Paris, 4 South-street, Finsbury, and Paris—Invention of a new material to be used in the manufacture of crystal, enamel, and other similar products.

Recorded August 29.

1953. John Hanson, Doagh, Belfast—Improvements in machinery or apparatus for digging or working land, and removing roots or plants therefrom.

Recorded September 6.

2019. James Fraser, Jermyn-street—An improvement in the manufacture of paper.—(Communication.)

Recorded October 9.

2252. Ellis Rowland and James Rowland, Manchester—Certain improvements in locomotive steam-engines.

Recorded October 12.

2279. John Clark, Strand—Invention of cooking apparatus for the pocket.

Recorded October 13.

2291. John Dewrance, Barge-yard, Bucklersbury—An improvement in the frames of pianofortes.

Recorded October 19.

2342. William Tatham, Rochdale—Improvements in machinery or apparatus for preparing, spinning, doubling, and winding cotton, wool, flax, silk, or other fibrous substances.

Recorded October 22.

2359. Alexander Parkes, Burry Port, Llanelly, Carmarthenshire—Invention of certain preparations of oils for, and solutions used when waterproofing, and for the manufacture of various articles by the use of such compounds.
2361. Charles Lenny, Croydon—Improvements in carriages.

Recorded October 23.

2369. John Bellamy, Lower-road, Islington—Improvements in graining and in producing imitative ornamental surfaces, and in certain instruments or apparatus to be employed for such purposes.

Recorded October 27.

2397. Edward Stark, Monkton, Isle of Thanet—Improvements in pens for writing.
2398. Henry Wyatt, 58 Pall-mall—Invention of a peculiar apparatus for more rapidly and perfectly manœuvring or steering steam ships of war or of commerce, which is entitled the "Transpulsor."

Recorded October 29.

2409. Thomas A. Temperton, Manchester—Certain improvements in shells and rockets, and other projectiles of a like nature.
2411. John Kennard, 32 Little Queen-street, Holborn—Improvement in the manufacture of children's and invalids' carriages.
2413. Germain J. P. M. Villeroux, Paris—Certain improvements in the manufacture of soap.
2415. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in regulating the transmission of motive power.—(Communication from François T. Moison, Mony, France.)

Recorded October 30.

2417. Paul E. Chappuis, 69 Fleet-street and 10 St. Mary Axe—Improvements in reflectors for the diffusion of artificial light.
2419. William Naylor, Norwich—Improvements in power hammers and riveting machines.
2421. Thomas Hocroft, Tividale, and Richard Forrest, Tipton, Staffordshire—Improvements in the manufacture of iron rods, bars, hoops, merchant and guide iron.

Recorded October 31.

2423. William H. Walenn, 46 Regent-street—Invention of self-acting attachment to be applied to gates.—(Communication.)
2425. James G. Lawrie, Glasgow—Improvements in shipbuilding, to facilitate the use of water as ballast.
2427. Henry E. Drayson, Maresfield Powder Mills, Sussex—An improvement in the manufacture of gunpowder.
2429. Thomas J. Swinburne, South Shields—Improvements in furnaces or apparatus used in the manufacture of glass.
2431. Richard P. Forlong, Bristol—An improved manufacture of manure.

Recorded November 1.

2433. James Leetch, Margaret-street—An improved method of constructing apparatus for the covering of the head.
2435. Henry Laxton, 19 Arundel-street, Strand—Improvements in gearing for increasing or decreasing rotary speed.—(Communication.)
2436. Richard R. Cox, Fareham, Hants—Improvements in the manufacture of artificial fuel.
2437. George Milner, 13 Hollen-street, Wourdour-street, St. Ann's—Certain improvements in the manufacture of bedstead bottoms, part of which improvements are applicable to various other purposes for commercial and domestic use.
2438. David L. A. Nicole, 16A, Chichester-place, King's-Cross—Improvements in apparatus for winding up watches.
2439. William Taylor, Haughton, near Shiffnal, Shropshire—An improvement or improvements in the manufacture of iron.
2440. John Pinches, Oxendon-street, Haymarket—An improved machine or apparatus for embossing paper, metal, and other substances by hand.
2441. Joseph Bentham, Bradford—Improvements in looms for weaving.
2443. Robert Kerr, Glasgow—Improvements in spinning together fibrous materials of different kinds.
2444. Lewis Normandy, 67 Judd-street, Brunswick-square—Improvements in securing the rails in railways.—(Communication.)
2445. William H. Walenn, 46 Regent-street—Certain improvements in pianofortes.—(Communication.)
2446. Edwin T. Truman, Old Burlington-street—Improvements in palates or holders for artificial teeth.

Recorded November 2.

2447. Isham Baggs, Pentonville, and Henry F. Osman, 33 Essex-street, Strand—Improvements in steam-engines, and in engines generally which are worked either by gas, air, or vapour, and in apparatus for generating electricity, for effecting parts of said improvements, and for other purposes.
2448. John Cottrill, Great Lever, near Bolton—Improvements in machinery or apparatus for washing, scouring, dyeing, sizing, and cleaning woven fabrics and yarns.
2449. Mark Osborne, Birmingham—Improvements in metallic bedsteads, and other articles of metallic furniture.
2450. John Patterson, Beverley, Yorkshire—Improvements in mills or machines for grinding, crushing, cutting, and hulling or shelling various kinds of farm produce, and also for crushing and grinding minerals and other substances.
2451. Robert Cook, Glasgow—Improvements in apparatus for effecting the operations of punching, riveting, and shearing.
2452. Werner Staufen, 9 Baker-street, Portman-square—Invention of a substitute for hair and other substances commonly employed for stuffing cushions, furniture, and other articles.
2453. Samuel Heseltine, Harwich—Improvements in the means of ascertaining the depth of water in rivers, harbours, and at sea.
2455. John Jones, St. Asaph, Flintshire—Improvements in electric telegraphs.

Recorded November 3.

2456. James S. Cottrill, Great Lever, near Bolton—Improvements in machinery or apparatus for washing, scouring, dyeing, sizing, and cleaning woven fabrics and yarns.
2457. James Heginbottom, Ovenden, Yorkshire—Improvements in furnaces and apparatus for generating steam, whereby the smoke will be consumed and the fuel economised.
2458. James Eastwood, Midgley, Yorkshire—Invention of certain machinery or apparatus for taking out the slubs, noils, and knots from worsted sliver, slubbing, and roving.
2459. James Pattison, Glasgow—Improvements in machinery for dressing and finishing woven goods and fabrics.
2460. George Davis, Southampton—Improvements in apparatus for letting in or shutting off water or other liquids.
2461. Thomas R. Cooper, Battersea-fields, South Lambeth—Invention for obtaining motion, with power and velocity, by purely mechanical means.
2462. William Robertson and James Henry, Edinburgh—Improvements in machinery for reaping and mowing corn or other agricultural produce.
2463. James Binning, Liverpool—Improvements applicable to embossing presses.
2464. James Greenshields, Glasgow—Improvements in the manufacture or production of drying oleaginous compounds.
2465. Thomas R. Bridson, Bolton-le-Moors—Improvements in preparing, beetling, or finishing textile fabrics.
2466. William Gardner, Droylesden, Lancashire—An improved method of manufacturing watches or other timekeepers, and also improvements in the machinery, tools, or apparatus for accomplishing the same.
2467. William P. Sharp and William Weild, Manchester—Improvements in the reeling or winding of cocoons, and in the manufacture of silk threads, and in machinery and apparatus for these purposes.—(Partly a communication.)
2468. Fennell Allman, Cambridge-terrace—Certain improvements in apparatus for the production of steam.
2469. George Lloyd, Birmingham—Improvement or improvements in illumination.
2470. George Collier, Halifax—Improvements in weaving carpets and other pile fabrics.
2471. Richard A. Brooman, 166 Fleet-street—Improvements in knitting machinery.—(Communication.)
2472. Richard A. Brooman, 166 Fleet-street—Improvements in generating motive power.—(Communication.)

Recorded November 5.

2473. Robert S. Garden, Piccadilly—Improvements in the manufacture of hats.
2474. John Hicks, Bedford-place, Clapham Rise—An improved guage valve, applicable to boilers of steam-engines, and to other purposes.
2475. Arthur Dobson, Belfast—Improvements in preparing certain unbleached linen fabrics.

2476. Francis Hawkes, West street, Reading—Improvements in the construction and arrangement of water-closet apparatus.

2477. James Nuttall, Silver-street—An improved gauntlet glove and cuffed glove.

2478. Henry C. Page, 1 Commercial-road South, Pimlico—An improved method of indurating marble and stone, and of permanently fixing colours therein, when colouring matters are applied thereto for producing a variegated pattern or device on the surface thereof.

2480. Maurice Guillemot, Paris—Certain improvements in stopping horses.

2481. George Burridge, Great Portland-street—Improvements in the preparation of glass for ornamental purposes.

2482. Peter M'Gregor, Dumbarton—Improvements in water-closets.

2483. George B. Locke, Notting-hill, Kensington—Invention of apparatus, apparatuses, or mechanism for placing detonating or fog signals on the rails of railways to be exploded thereon, and for removing the same therefrom whenever required.

2484. Thomas Thomas, Bristol—Improvements in the manufacture of soap.

2485. Alfred V. Newton, 66 Chancery-lane—Improved apparatus for cooling and drying flour.—(Communication.)

2486. Alexander C. L. Devaux, King William-street—Improvements in the construction and the fitting up of granaries.

2487. Richard A. Brooman, 166 Fleet-street—Improvements in fire-arms.—(Communication.)

Recorded November 6.

2488. Joseph Jessop, Lascelles Hall, near Huddersfield—Improvements in the construction of furnaces and boilers.

2489. Frederick L. H. Danchell, 4 Arthur-terrace, Caledonian-road, Islington—Certain improvements in apparatus for ascertaining the pressure of steam, air, water, or any other fluid or liquid.

2490. Richard Goose, Birmingham—Improvements in the manufacture of cut nails.

2491. Joseph Schloss, Wellington Chambers, Cannon-street West—Invention of a new mounting for travelling-bags.

2492. Richard Threllfal and John Higson, Preston—Improvements in machinery or apparatus used in preparing or sizeing and dressing yarns for weaving.

2493. Samuel C. Lister, Mauningham, near Bradford—Improvements in weaving pile fabrics.

2494. Anthony Dugdale, Paris—Improvements in the construction of locomotive engines applicable in part to marine and stationary engines.

2495. Edward Jeffreys, Shrewsbury—An improvement in the construction of furnaces.

Recorded November 7.

2496. George Cotsell, Brompton, Kent—An improved gutter and kerb for roads and streets.

2497. Gharles Hanson, Pimlico—Improvements in fire-arms.

2498. Charles Hart, Wantage, Berkshire—Improvements in threshing and dressing machines.

2499. Joseph Haley, Manchester—Improvements in the buffers and spring draw-bars of waggons or other railway vehicles, and in the application of the same.

2500. Frederick Scholefield, Manchester—Improvements in machinery or apparatus for cutting paper, card-board, and similar materials.

2501. William G. Craig, Gorton, near Manchester—Improvements in bearing, buffing, and draw-springs, applicable to the rolling stock of railways and other vehicles.

2502. William Kenworthy, Blackburn, Lancashire—Certain improvements in steam-engine valves, and in the mode of working the same.

2503. William Davis, Northampton-place, Old Kent-road—Improvements in the construction and arrangement of furnaces and furnace-bars, for the better combustion of smoke and prevention of loss of heat by radiation.

2504. Louis B. Advielle, Paris—An improved process for silvering metallic articles.

2505. William Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture and application of prussiates and other colouring matters.—(Communication.)

2506. John Wakefield, Inchicore Works, Dublin—Improvements in machinery for working the slides and steam-valves of engines driven by steam or other elastic fluid.

2507. William Dray, Swan-lane—Improvements in apparatus for heating, baking, and drying.

2508. Gharles M. Pouillet, Paris—Certain improvements in railways.

2509. William Lund, Fleet-street, and Alexander Bain, Paddington—Improvements in pencil-cases.

2510. Thomas Godding, Ipswich—Improvements in the fastenings for stays, corsets, and bands.

2511. Charles A. Browne, Massachusetts, U.S.—Invention of a machine for manufacturing bricks.—(Communication.)

2512. Henry J. Betjemann, New Oxford-street—Improvements in expanding or extending tables.—(Partly a communication.)

2513. George T. Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in wrought-iron shafts for steam-boats, and other purposes where a great strength is required.—(Communication.)

2514. Charles W. Siemens, Adelphi—Improvements in evaporating brine and other liquids, and in distillation.

2515. Thomas Bargin, Great Winchester-street—An improved construction of ledger hand rest.

Recorded November 8.

2517. Charles Page, Ware, Herts—An improved construction of railway signal apparatus.

2518. Louis Gastè, 58 Paradis Poissonnière, Paris—Improvements in binding account and other books.

Recorded November 9.

2521. John Raywood, Wentworth—An improved rolling, dribbling, sowing, and harrowing machine for wheat and other agricultural produce.

2522. George B. Goodman and George A. Webster, 21 York-buildings, Marylebone—Improvements in apparatus for reflecting the back, front, and sides of the figure and head in a mirror or toilette glass at one view.

2523. Henry Fletcher, Manchester—Improvements in the manufacture of nuts, bolts, and other similar articles, and in machinery and apparatus for making the same.

2524. James Bramwell, Royal Exchange-buildings, and John Grawford, Newcastle-upon-Tyne—Improvements in ordnance.

2525. William H. Walenn, 46 Regent-street—Certain new and useful improvements in looms for weaving seamless bags and other open double fabrics of a similar character.—(Communication.)

2526. Charles J. Hampton, Llynrivale, Glamorganshire—Improvements in the manufacture of iron.

2527. Thomas Pritchard, Walsall—Improvements in manufacturing welded iron tubes.

Recorded November 10.

2528. William P. Piggott, 523 Oxford-street—Improvements in galvanic, electric, and electro-magnetic apparatus, and in the mode of applying the same as a curative and remedial agent.

2529. William H. Bentley, Bedford—Improved cannon, guns, and other fire-arms, and appendages thereto, and in the capsules, cartridges, and projectiles for the same and other fire-arms.

2530. Joseph Scott, Glasgow—Improvements in corking bottles, jars, and other receptacles.

2531. Louis Eskell, 22 Cockspur-street, Pall-mall—Invention of a new enamel for filling or stopping decayed teeth.

2532. Alfred V. Newton, 66 Chancery-lane—Improvements in transmitting fac-simile copies of writings and drawings by means of electric currents.—(Communication.)

2534. Henry Wickens, 4 Tokenhouse-yard, Bank—Improvements in locomotive steam engines, and in apparatus in connection therewith, parts of which improvements are respectively applicable to other steam engines and purposes.

Recorded November 12.

2535. William Crosley, 16 Westbourne-park, and 103 Southwark-bridge-road—Improvements in gas meters.

2536. Jules C. A. Bouillotte, Paris—An improved letter copying-press.

2537. Louis J. F. Margueritte, Paris—Certain improvements in the manufacture of vitreous products.

2538. William K. Hall, 36 Cannon-street—Invention for the prevention of steam boiler explosions.

2539. William K. Hall, 36 Cannon-street—Improvements in boilers for generating steam —(Communication.)

2540. George Cooke, Kersley, Lancashire—Improvements in flyers used in roving and slubbing frames.

2541. Thomas Hitt, Tavistock-street—Invention of a new method of obtaining power for propelling vessels, and certain new propelling machinery.

2542. John Y. Borland, Manchester—Improvements in spinning, and machinery for preparing and spinning fibrous materials.

2543. William H. Aston and Samuel Hopkinson, Zetland Mill, Huddersfield—Improvements in steam-boiler furnaces and apparatus employed for supplying water to steam boilers.

2544. Joshua Kidd, 75 Newgate-street—Improvements in machinery and apparatus for sewing or stitching and ornamenting cloth or other fabrics.

2545. Andrew Barclay, Kilmarnock—Improvements in indicating the pressure of steam and other fluids, which improvements are also applicable to governors and other regulating apparatus.

2546. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in casting metals.—(Communication from Jackson Brothers, Petin, Gaudet, & Co., Rive de Gier, France.)

2547. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture or preparation of hard india-rubber, and in the application thereof to the construction of parts of textile and other machinery.—(Communication from Henri V. Wacrenier, Paris.)

2548. William C. Thornton and Benjamin Thornton, Gleckheaton, Yorkshire—Improvements in machinery or apparatus for preparing and spinning wool, which improvements are also applicable to washing and wringing machines for the same material.

2549. William Henson, Bryan-street, Caledonian-road, and Henry O. Palmer, Castle-street, East-street, Marylebone—Improved apparatus for propelling vessels.

Recorded November 13.

2551. Fischer A. Wilson, Adelphi Chambers—Improvements in engines, machinery, and apparatus for exhausting, forcing, and lifting, for propelling on land and water.

2552. Julius Homan, Milk-street, Cheapside—Improvements in machinery for cutting up woven and other fabrics.

2553. John Wilkinson, elder, and John Wilkinson, younger, Leeds—Improvements in communicating a shape or configuration to felted cloths and other manufactured fabrics.

2554. William Webb, John Webb, jun., and James Catstree, Birmingham—Improvements in attaching door knobs to spindles.

2555. John Mawson, Newcastle-upon-Tyne—Improvements in cameras for taking photographic pictures.

2556. Frederick A. Eskell, Manchester—Improvements in plates for attaching artificial teeth.

2557. Robert Murdoch, Glasgow—Improvements in agricultural apparatus for sowing seeds and depositing manure.

2558. William Foster, Black Dike Mills, near Bradford—Improvements in machinery or apparatus for drying wool and other fibrous materials.

Recorded November 14.

2559. Alexandre Tolhausen, 7 Duke-street, Adelphi—Certain improvements in producing ice.—(Communication from Louis J. F. Margueritte, Paris.)

2560. Henry Laxton, 19 Arundel-street, Strand—Improvements in fire-arms.—(Communication.)

2561. James Burrows, Haigh Foundry, near Wigan—Improved apparatus for winding coals or other minerals from mines, which said apparatus is also applicable for other similar purposes, and for machinery required for forming or constructing such improved apparatus.

2562. Thomas Skinner, Sheffield—Improvements in producing figures or ornaments upon the surfaces of metals.

2563. William Barnes, 2 Royal Exchange-buildings—An improvement in connecting and supporting the ends of the rails of railways.

2564. Cyprien M. Tessié du Motay, Paris—Improvements in the manufacture of lubricating materials.

2565. Joseph Robinson, Denton Mills, Carlisle—Improvements in machinery for drying wheat and other grain.

2566. Cyprien M. Tessié du Motay, Paris—Improvements in the treatment of fatty and oily matters.

2567. Charles Goodyear, Paris—Improvements in shoes and boots when india-rubber is used.

2568. George T. Bousfield, Sussex-place, Loughborough-road, Brixton—An improved safety coal-hole cover.—(Communication.)

2569. Frank Jacques, Droylsden, Lancashire—Invention of the use and method of preparation of a new material to be used in the process of dyeing silk.

2570. Edmond G. Gox, Lile, France—Certain improvements in picking or cleaning cotton, wool, and other filamentous substances.

2571. Alfred V. Newton, 66 Chancery-lane—An improved manufacture of electrotype printing surfaces.—(Communication.)

2573. Johannes Möller, 3 Maynard-place, Hornsey—Invention for producing a transparent photographic picture on ivory, without injuring the nature of the ivory, so as to be able to finish the picture with colours like other miniatures.

Recorded November 15.

2574. John T. Pitman, 67 Gracechurch-street—Improvements in the construction of iron beams and girders, and in machinery for making the same.—(Communication.)

2575. Franz Duncker, Berlin, Prussia, but now of King William-street, Strand—Invention of a new instrument for electric telegraphs, called "Despatch Distributor," which will permit despatches of various contents being communicated at the same time to one or more stations by means of one or two line wires only.—(Communication.)

2576. Joseph L. Hinks, Birmingham—An improvement or improvements in brushes.

2578. William Lea, Wolverhampton—An improvement or improvements in taps or cocks.
2579. John H. Johnson, 47 Lincoln's-inn-fields, and Glssgow—Improvements in carding engines for carding cotton and other fibrous materials.—(Communication from George Wellman, Lowell, U.S.)
2580. Duncan Morrison, Bordesley Works, Birmingham—An improvement in the manufacture of articles with internal screws, when cast-iron, malleable cast-iron, or cast-brass is employed.
2581. George T. Bousfield, Sussex-place, Loughboro'-road, Brixton—Improvements in breech-loading fire-arms.—(Communication.)

Recorded November 16.

2582. Charles Crum and Charles Paul, Hudson, Columbia, U.S.—Invention of a process for making bread.
2583. Benjamin T. Babbitt, New York, U.S.—Invention of manufacturing soap.
2585. William Eassie, Gloucester—Improvements in hammers.
2586. Thomas Hudson, Warrington—Improvements in machinery or apparatus for cutting and punching metals, paper, leather, and similar articles.
2587. James Yates and Thomas R. Birch, Birmingham—An improvement or improvements in engines for raising beer and other liquids.
2588. James Hinks and Frederick Dowler, Birmingham—A new or improved machinery for the manufacture of percussion caps, and for cutting out and raising articles in metal generally.
2589. Edward Peyton and Duncan Morrison, Bordesley Works, Birmingham—Improvements in manufacturing parts of metal bedsteads.
2591. Louis A. Petard, Paris—Certain improvements in manufacturing velvet and other similar fabrics.

Recorded November 17.

2592. John Hosking, Gateshead Iron Works, Durham—Improvements in vertical direct-action marine engines.
2593. Joseph Denton, Pendleton, near Manchester—Improvements in looms.
2594. Henry Ball, Great Russell-street, Birmingham—An improvement in gun-sights.
2595. Robert W. Swinhurne, South Shields—Improvements in furnaces used in the manufacture of glass.
2597. George Collier, Halifax, and James W. Crossley, Brighouse, Yorkshire—Improvements in means or apparatus employed in hot-pressing woven fabrics and other surfaces.
2598. George Collier, Halifax, and James W. Crossley, Brighouse, Yorkshire—Improvements in finishing fabrics and in treating yarns, part of which improvements is also applicable to producing ornamental effects upon other surfaces.

Recorded November 19.

2600. John Fleetwood, Elm Grove House, Southsea—An improved portable apparatus for making malt, and for drying hops, corn, and other grains and seeds.
2602. William Smith, Salisbury-street, Adelphi—Improvements in gas regulators.—(Communication.)
2604. Richard A. Brooman, 166 Fleet-street—Improvements in apparatus for measuring liquids, which may also be employed as a motive power engine.—(Communication.)
2606. Jeanne B. Ve. Lopez, 57 Rue de Bretagne, Paris—Invention of an antibilious powder.
2608. William H. Precce, 7 Bernard-street, Primrose-hill—Improvements in electric telegraphs.

Recorded November 20.

2610. John Poole, 2 Riley-street, Chelsea—An improved mode of regulating the supply of steam from the boiler to the cylinder, and thereby better governing the motion or speed of steam-engines.
2612. Alfred V. Newton, 66 Chancery-lane—Improved apparatus for dressing flour.—(Communication from Pierre B. J. E. Cabanes, Bordeaux, France.)
2614. William Harvey, Mansfield, Nottinghamshire—Invention of an apparatus to be employed with reels, cylinders, or rollers, and for placing upon or taking off therefrom hanks, skeins, hands, and other articles, without removing such reels, cylinders, or rollers from their bearings.
2616. Charles F. Clark, Wolverhampton, and Manoah Bower, Birmingham—Improvements in bolts and fastenings, which they propose calling "Clark & Co.'s longitudinal wedge bolt."
2618. David S. Price, 2 South Moulton-street, and Edward C. Nicholson, 3 Newington-crescent—Improvements in the manufacture of cast-iron.
2620. Oliver Maggs, Bourton Foundry, Dorset—Improvements in machinery for thrashing and winnowing wheat and other grain.
2622. Coleman Defries, Houndsditch—Improvements in the roof lamps for railway carriages.

Recorded November 21.

2626. Peter Armand le Comte de Fontaine-Moreau, 4 South-street, Finsbury, and Paris—Improvements in treating fatty acids.—(Communication.)
2628. Henry W. Wimshurst, St. John's-wood—Improved machinery for cutting dovetails and tenons.

Recorded November 22.

2630. Alexandre Tolhausen, 7 Duke-street, Adelphi—Certain improvements in bombs and other explosive projectiles whose charges are to be fired by percussion.—(Communication from Horace P. Herdman, New York, U.S.)
2632. George Price, Cleveland Safe Works, Wolverhampton—Invention of a box, chest, or case, for the preservation of parchment deeds and documents from damage by steam, when placed inside an iron safe, made fire-proof on the vapourising principle.—Milner's Patent, 1840.
2634. Henry Hibling, Norwich—Improvements in waterproof boots and shoes.
2638. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in apparatus for making aerated beverages.—(Communication.)

Recorded November 23.

2640. Thomas Tuckey, Cork—Invention of modes of construction, by which steam or other vapour or gas may be used as a source of motive power for some purposes more conveniently than hitherto, and more suitably for locomotion on common roads.
2642. John P. Fisher, Edgbaston, near Birmingham—Certain improvements in the construction of the hammers of pianofortes.
2644. Joseph Ellisdon, Liverpool—Improvements in "castors" for cabinet furniture.
2646. Samuel C. Lister, Bradford, and James Warhurton, Addingham, Yorkshire—Improvements in spinning.

Recorded November 24.

2648. Samuel R. Carrington, Stockport—Certain improvements in the manufacture of hats.
2650. John J. Rowley, Rowthorn, near Chesterfield—Improvements in machinery for cleaning and cutting turnips and other roots.
2652. Juliana Martin, Soho-square—An improved self-acting incubator.
2654. Hiram Hyde, Truro, Nova Scotia—Improvements in the manufacture of mineral oils.—(Communication.)

Recorded November 26.

2658. Enoch Harrison and Hilton Greaves, Manchester—Improvements in the manufacture of woven fabrics.
2660. Thomas Greenwood, Leeds—An improvement in the construction of carding engines.
2662. George E. Dering, Lockleys, Hertfordshire—Improvements in galvanic batteries.
2664. James Clark, 25 Billiter-street—Improvements in the chain wheels used on capstans, windlasses, and other axes.

Recorded November 27.

2666. Thomas Allan, Adelphi-terrace—Improvements in applying electricity.
2668. Hiram Hyde, Truro, Nova Scotia—An improved manufacture of lubricating compound.—(Communication.)
2670. Enoch Tayler, 62 Baldwin's-gardens, Gray's-inn-lane—Improvements in paddle-wheels for propelling vessels in water.
2674. Samuel A. Kirhy, Hastings-street, Leicester—Improvements in open stoves and grates for rooms and apartments.
2676. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in sheathing ships.—(Communication from Messrs. Jackson, Brothers, Petin, Gaudet, & Co., Rive de Gier, France.)
2678. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in cleaning and hulling grain and seeds, and in the machinery or apparatus employed therein.—(Communication from Charles T. Laborey, Paris.)
2680. Thomas Warren, Glasgow—Improvements in the manufacture and moulding or shaping of glass.

Recorded November 28.

2682. Charles H. Holt, Manchester—Improvements in steam boilers, furnaces for the same, and apparatus connected therewith.
2684. George Richardson, Craig's-court, Charing-cross—Improvements in buffer, draw, and bearing springs for railway carriages and waggons.—(Communication.)
2686. Joseph Lee, Stonall, near Walsall, Staffordshire—Improvements in agricultural or farmer's engines, which improvements are applicable also to locomotive engines.
2688. William A. Distin, 31 Cranbourn-street, Leicester-square—Improvements in cornets and other wind musical instruments.

Recorded November 29.

2692. Arthur W. Forde, 45 Bernard-street, Russell-square—Invention for registering the number of revolutions of a wheel of a locomotive engine, or railway or other carriage, at any given period.
2694. William Irlam, Gibraltar Iron Works, Newton Heath, near Manchester—Improvements in crossings for railways.

Recorded November 30.

2700. John Ramsbottom, Accrington, and John C. Dickinson, Blackhurn, Lancashire—Improvements in machinery or apparatus for measuring and registering water and other fluids, and obtaining motive power from the same.
2702. Edward D. Johnson, Wilmington-square—An improvement in the construction of attachable seconds watches.
2704. Richard Hancock, Great Polgooth Mine, St. Austell, Cornwall—Invention of cleaning and separating ores of every description when brought into a state of low pulverization.
2706. Samuel C. Lister, Bradford—Improvements in treating so as to rework waste yarns of cotton, silk, flax, or other fibre.

Recorded December 1.

2708. William Ward, Warrington—Certain improvements in looms for weaving.
2712. James M. Napier, York-road, Lambeth—An improvement in drying small coal.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

DESIGNS FOR ARTICLES OF UTILITY.

Registered from Oct. 24th to Nov. 13th.

Oct. 24th,	3773	Fairbanks & Lavender, Walsall,—"Stirrup."
25th,	3774	S. Twist, Birmingham,—"Billiard table."
"	3775	J. Fairman, Bishopsgate-street,—"Perflated coat."
31st,	3776	W. Tasker and C. Haslem, Newbury and Reading,—"Wheel roller for clod crushers."
Nov. 6th,	3777	J. Finlayson, Pendreich,—"Plough guide."
"	3778	A. Hibbs and W. Acton, Sheffield,—"Throttle valve."
7th,	3779	C. Burton, Oxford-street,—"Nursery swing."
8th,	3780	W. Garston, Baker-street,—"Corbillard or hearse."
9th,	3781	S. Challinor, Fleet-street,—"Bottle-holder."
10th,	3782	W. Kennard, Holborn,—"Parts of a lock."
12th,	3783	J. Shaw & Co., Sowood-hill, York,—"Wire heald."
"	3784	T. B. Sharp and W. F. Batho, Manchester,—"Cutting tool."
13th,	3785	A. Love, Liverpool,—"Cooking lamp and stand."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered.

Oct. 25th,	708	S. Norris, Horsferry-road,—"Expanding boot."
Nov. 8th,	709	W. A. Lyttle, Cooteshill, Cavan,—"Lock-protector."
10th,	710	T. & C. Clark, Wolverhampton,—"Sash-frame pulley."
14th,	711	E. Israel, St. Mary Axe,—"Glove-purse."
15th,	712	G. S. S. Gower, Ipswich,—"Shirt-front."
17th,	713	S. Limeheer, Pentonville,—"Basket-sifter."
"	714	R. Martin, King's-cross,—"Gutta percha golosh."

TO READERS AND CORRESPONDENTS.

Pericles, Paisley, should possess himself of an "Illustrated Index" of the volumes of this *Journal*. He will find from it that we have given a great many articles on the subject of reaping machines. See also p. 246, vol. vii.

Galvanic Light.—A correspondent puts the following questions to us:—"What are the numbers and sizes of plates required for the production of a good galvanic light? The best proportions of the acids? Are charcoal points the best? Would a great number of points in the chain lessen the brilliancy of each? Could a large open workshop be illuminated by galvanic action?"

STEAM BOILER FURNACES,

W. S. YOUNG, PATENTEE, LEITH.

Fig 1.

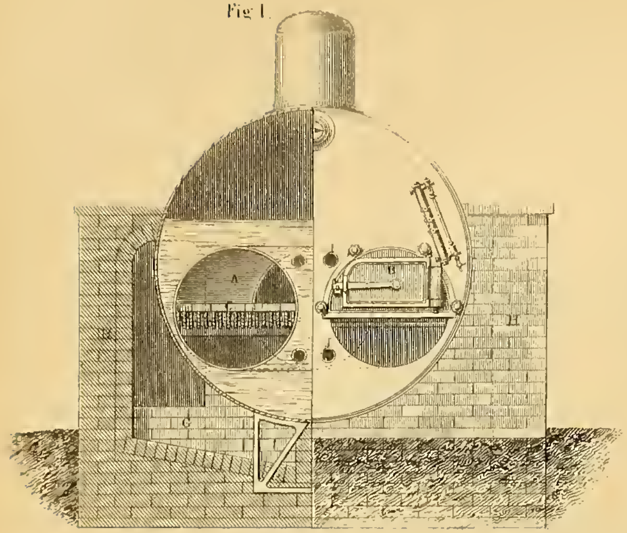


Fig 2.

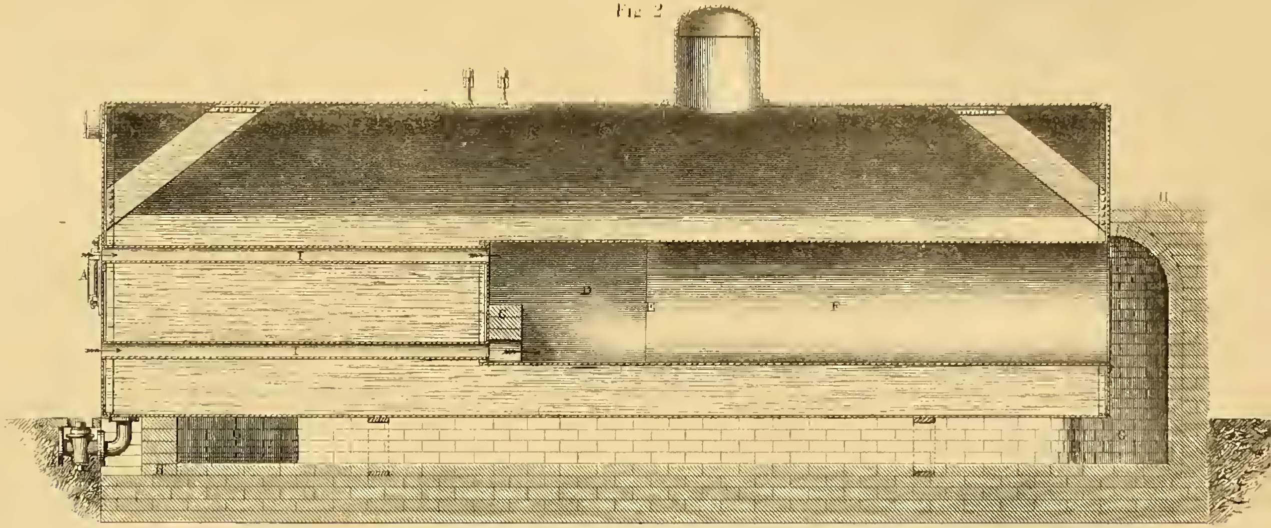


Fig. 3.

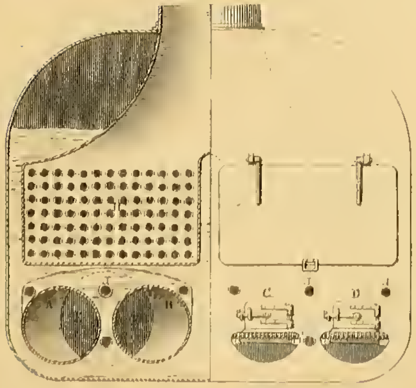


Fig. 4.

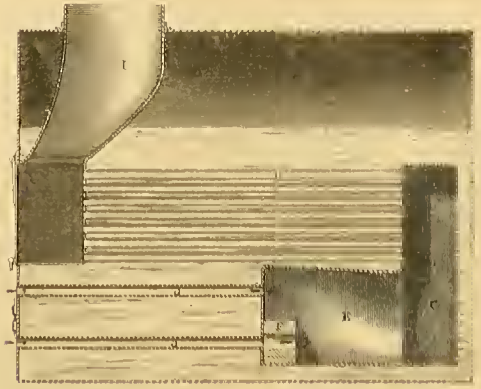
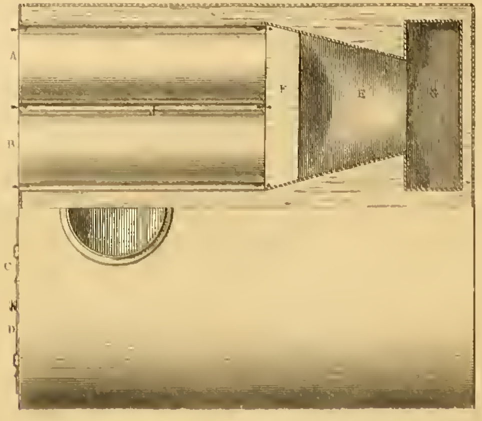


Fig. 5.



W. Johnson, Patent Offices.
47 Lincolns Inn Fields & Glasgow

SCALE

STATIONARY CROSS-CUT SAWING MACHINE,

Erected at the
ROYAL ARSENAL, WOOLWICH,
By
JOHN Mc DOWALL & SONS
WALKINSHAW FOUNDRY,
JOHNSTONE.

Fig. 1.

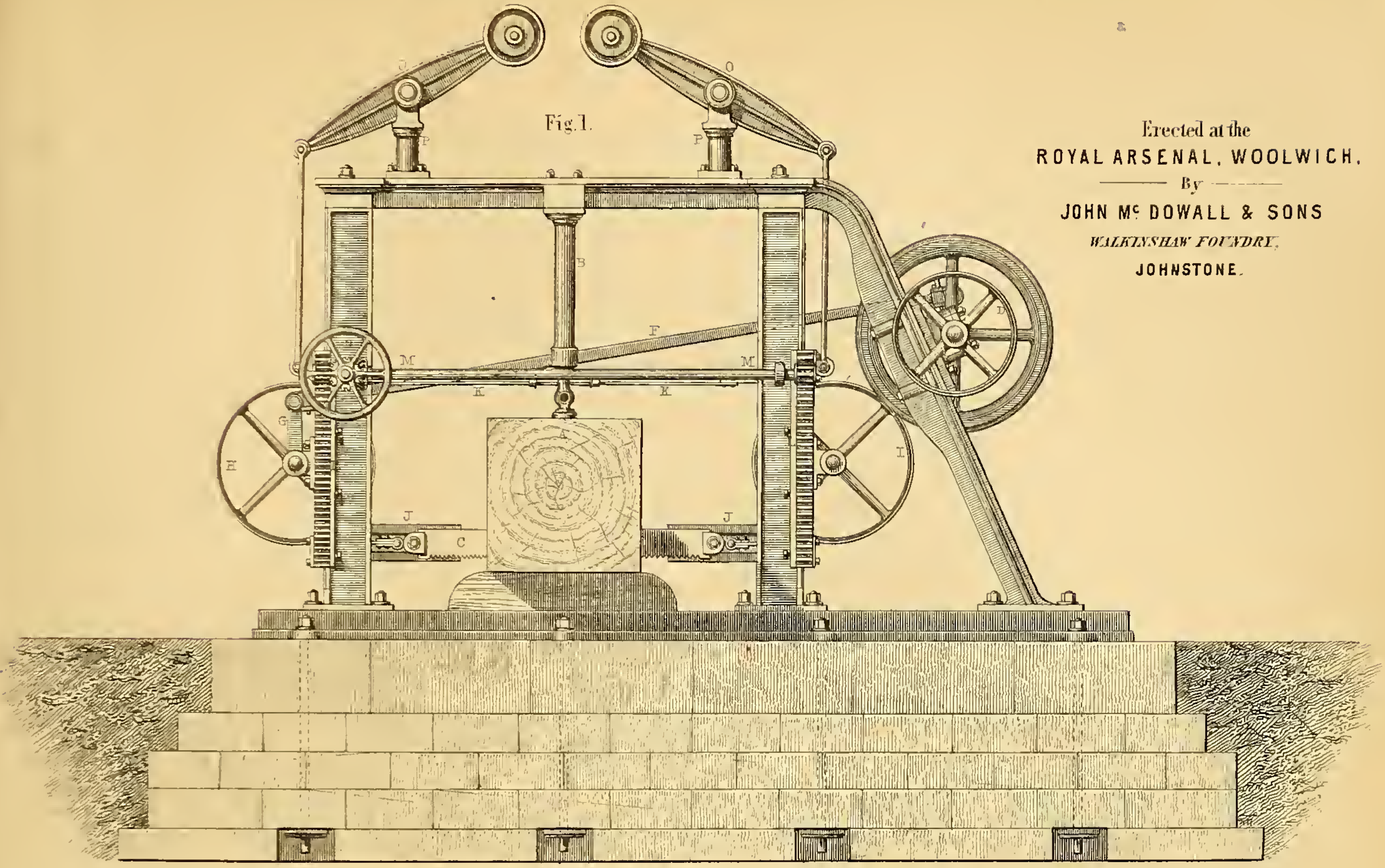


Fig. 2

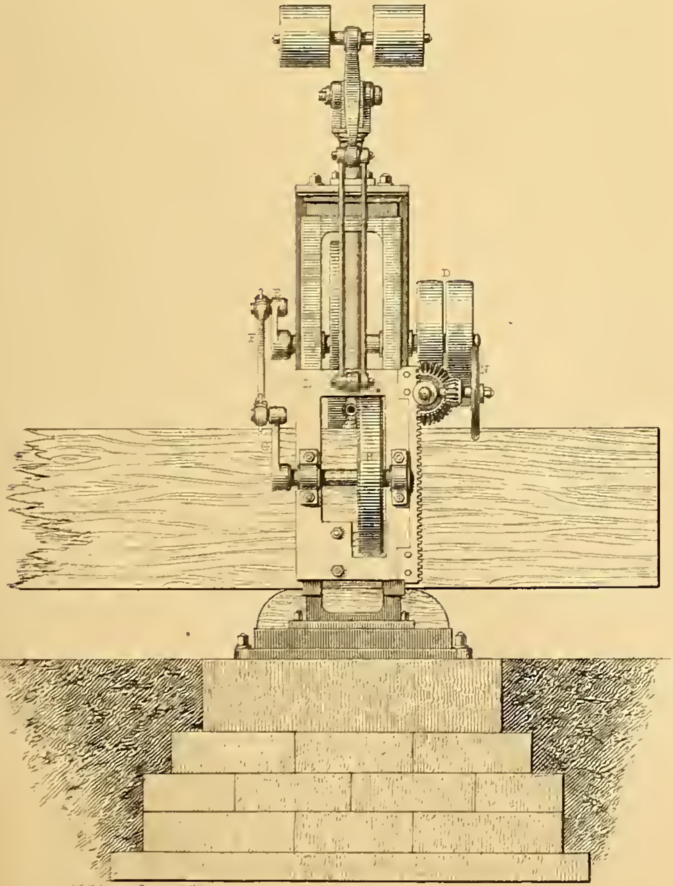
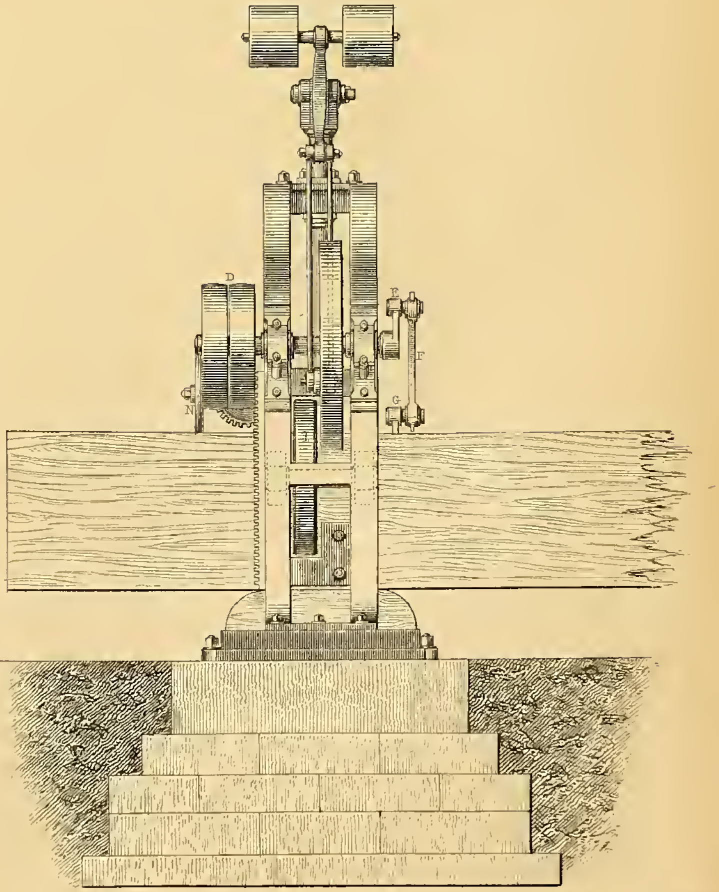


Fig. 3.



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WORK FOR INVENTORS.

The patented inventions of the time are often cited as examples of fearfully misapplied ingenuity, and it is remarkable enough that we should have so long submitted to the many inconveniencies which are so excessively palpable on every side of our existence, whilst the world is peopled with panting inventors, seeking everywhere for outlets for the development of what they conscientiously consider to be high-souled inspirations. There is an inconsistency in this, which it requires some thoughtful consideration to see through. A vast proportion of inventions are inopportunely born; and it is equally certain, that no inconsiderable number of schemes are practically failures, from pure mismanagement in their introduction and working. The truth seems to be, that too little consideration is given to the real wants of the times; so many minds are engaged upon inventions which are hardly required, that a great many really glaring defects are overlooked and forgotten.

From the time that we leave our pillows in the early morning, to the hour of returning to them for another instalment of refreshing rest, we are more or less galled by defects and inconveniencies, which every one sees, but no one attempts effectively to remedy. Our clothing is too complex, and ill fitted as it is, to resist the cold dampness of the British climate, it is for the most part far too restrictive upon the natural movements of the body. The leather of which our shoes are made is spongy, porous, and unpleasant in texture and odour; it is permeable by every puddle, and melting snow passes through it as through a sheet of filtering paper. If it is waterproofed, all egress is denied to perspiration, and the foot is, in the main, still worse off.

Look at the internal fittings of our houses:—Our chimneys will smoke and want sweeping,—our fire-grates will consume inordinate quantities of fuel, letting the heat thereof fly away and leave the rooms cold,—our fires are difficult to light, and the process is injurious to furniture and decorations of every kind,—door handles and locks are always rickety and deranged, whilst the fitting portions of doors and windows seem to be expressly contrived for producing blasts of freezing air. The English sash is so awkward that we have attempted the French centrally-divided window; but here, imperfect construction usually brings us back to our old notions. Those light-valves, blinds, from the antique-sheeted roller, with its sticking and breaking endless cord, to the neat-looking venetian, are replete with troubles, and make us long for something which will afford a screen without involving break-down complexities.

When we go out, we find that even our wealthiest cities are too poor, or too passively supine, to furnish dry and cleanly footways. The evil is bad enough even when well-flagged trotoires are provided; but we shudder to contemplate it, when we remember the condition of our suburban paths. Surely it would be no very difficult matter to devise some cheap substratum, which would be dustless in our meagre allowance of dry weather, and which would rapidly run off the rains of heaven so plenteously supplied to us.

Railways have grown into fine examples of what refined invention continuously applied can accomplish. But what of our main thoroughfares, open roads, and streets? It was thought to be a splendid step, when Macadam gave us his broken stone layer system; but this road, excellent as it is, when at its best, is fit only to be classed amongst the things which modern invention has forgotten and left behind. No horseman who values his horse's knees, and is duly thoughtful concerning his own neck, can traverse a macadamised road anytime between October and April, without wishing that the "Colossus of Rhodes," as some one with meagre wit has styled him, had devoted his talents to something less hurtful to the human race, and to the dumb animals under human care. If we must rely upon these layers of sharp angular stone fragments for eventually giving a firm, level, and easy road, let us have some means of getting them under the earth's surface as quickly as possible. As matters exist, we have, in the autumn and winter, to wade through an almost impassible stratum of jagged stones, to be succeeded only, in the early budding and spring of the year, by morass-like mud puddles, followed by the dust of summer. In towns where the severity of the traffic demands something more enduring, the practice is so varied as to become the inevitable tell-tale of street makers' misconceptions of their subject. Fleeing from the evils of stone paving, they took refuge in wood; wood pavement got into great undulating hollows, and its slippery face proved its death-blow, so that stone is again in the ascendant. But, with the exception that greater expense is now lavished upon the material and workmanship, we are no better off in this respect than we were a score of years ago. Stone pavement gets round on the face and excessively slippery, whilst the cost of really fair work of the kind is enormous. Stone and wood combined has been tried to a limited extent, and with some points of success; cast-iron has also been laid down in isolated situations, but this material has hardly received fair usage. Cannot the inventor find employment, and do the world good service here? and seeing the excessively crude system of hand cleansing, and the comparatively superior results of Mr. Whitworth's mechanical sweeper, can he not suggest some amendment upon the process, and give us as well a simple and inexpensive means of cleansing our footways?

A few words may also be said on horse shoeing. Nothing can be more barbarous than the present system of driving nails into a hoof to hold on a heavy, and often misshapen, lump of iron. Apart from the frequent lamenesses attributable to this pulling about of the feet, the action of hard, unyielding metal, as the only interposed medium between the beautiful and delicate mechanism of the foot, and the solid surface of an English road, is far from being in accordance with the intentions and provisions of nature, and with our own desires as respects safety and endurance. We must protect the horny hoof, it is true, and nothing seems to be so suitable, in the present state of our knowledge, for this purpose as iron; but the improver in search of a subject for the exercise of his genius, may take in hand a worse thing than the discovery of a new plan of attachment, whereby the shoe may be better fitted to the animal's sole, with greater security from looseness, and with less chance of injury to vital parts, than the sadly unscientific process of nailing. It has already been suggested, that caoutchouc might be judiciously substituted for iron and nails; but the notion does not appear to have been acted upon, nor indeed does caoutchouc present features of sufficient stability and endurance to offer a fair chance of success. Nevertheless, we want more elasticity, and a better and less complex system of attachment—points which, from the universal use of roadster horses, are well worth considerate attention.

The "hard rubber," or sulphurised caoutchouc, subjected to excessive temperatures, and of which so many beautiful nick-nacks are now made, has been proposed as a substitute for iron in making the shoes, and we have as yet heard no satisfactory reason alleged for the non-application of the idea. The combs, boxes, sticks, and other articles, now produced in great quantities from this admirable material, show that it possesses high qualities of hardness and durability, combined with an extremely tractable nature, so that the hint for an extension of its usefulness in this direction may perhaps not be utterly lost.

Arguing upon the unshod condition of horses in a state of nature, some one has also proposed to subject the hoof to an indurating process, so that, without any protective shoe, the foot might be secured from serious wear. This has yet to be accomplished.

The key-note upon the universal ignorance as to "common things," so well sounded by Lord Ashburton, and so closely followed up by later thinkers who fell in with his train of observation, must ring yet more loudly in the ears of inventors, if permanent good is to be effected in the way we have pointed out: for it is to this very misapprehensive ignorance, this educational blank, that the birth of so much misdirected ingenuity is to be attributed. A true conception of the existence, origin, and bearing of defects can alone lead to really remedial measures, and enable the man who is ambitious enough to be an inventor, to strike out the fire of improvement from the crude rocks of hitherto barren and uncultivated places. When this knowledge is even partially obtained, the power of the inventive mind may be laid upon it with a profitable result; for a satisfactory arrival at the root of a want, is emphatically the essence of the inventor's labour. To be far in advance of the time is an objectionable position, only rivalled by falling behind it; and if the drafts of a schemer are only to be honoured in a future age, his exertions serve but to remind us, that however much he may be venerated hereafter, he is a cipher for the present. And more than this, we have then the uninviting contrast between the neglect of existing evils, and the devotion of talents to remote contingencies, which may or may not eventuate in beneficial applications, whilst they cannot, by any possible chance, touch the time before us, with which alone the inventor has a right to deal. When the actually existing food for speculative discussion has been exhausted, when the glaring deficiencies of the time have met with substantial alleviation, we may pardon the inventor for looking far before him—but not till then.

We purposely restrict our suggestions to "common things," as they are always with us, but let us not be supposed to narrow the inventor's field of action. Far from it: we propose to widen it in a healthy manner, by first of all securing attention to what is directly around us, so that we may approach the more surely to matter of higher import, concerning not only the present time, but the age which is to come.

With an annual crop of some 3,000 patented inventions, it can then hardly be too much for us to ask for somewhat more attention to those wants which are so disagreeably perceptible in every-day existence. There is scope enough amongst them for the full employment of a large proportion of this inventive capital, whilst such a diversion of it to the direct and immediate wants of the time, promises the speediest return of the highest rate of interest.

Separating the really progressive improvements from those which either lag behind, or overshoot the requirements of the day, the rough analysis tells us that the former are almost exclusively directed to the cheapening of staple processes—to the spinning of two threads where but one was spun before. Such economy most undoubtedly brings with it an increase in the aggregate comforts of the human family, for it enables the dairymaid to purchase a silk dress for the price which her grandmother gave for a cotton one; and it gives her a printed garment at a cost which, not very long ago, would have been swallowed up by the trimmings thereof alone. It changes the price of the steel pen from many shillings a piece, to a few pence a gross. But whilst these examples of cheapness show that the poor of our time may reasonably indulge in what were luxuries indeed to the wealthy in a former generation—and in so far that the well-being of the mass is soundly improved; yet we must not lose sight of the fact, that the quality of the reasonable necessaries of life has not by any means kept pace with this scale of advancement. In many instances of extraordinary progress in production, the intrinsic value of the manufactured article has sadly fallen away, so that what was unquestionably dear enough twenty years ago, cannot now be had at any price. The truth is, that we have run too much into cheapness, as if the value of an article were to be measured by that element alone. Apart from this result, and aggravated by it, we have the fact before us, that long-tried possessions have felt too little of the progressive spirit of the age; and in the midst of vast accessions in number, we have not had a fair share of the refinements of invention—points which have been in too many instances overlooked and forgotten.

Is there not more of knowledge than of wisdom in all this?

> "Knowledge is proud that he has learned so much;
> Wisdom is humble that he knows no more."

The wisdom of the many is in too many instances devoid of that wit of one, which alone can bring it down to practice, and convert floating suggestions into valuable realities. For the multitude of suggestive ideas are like the sparkling diamond—although they bear strong witness of their value, they are usually easier to find than to polish up for use after their discovery.

But the world never saw a time when prospective improvements were more greedily laid hold of than at present. One week we read of the partial development of some striking novelty, and the next sees its practical adaptation. If there is work for inventors, then, is there not bright hope for them also?

CONSUMPTION OF SMOKE.

Upon this subject, so important to the health of the community, and upon which so much inventive talent has been employed, a report has been lately drawn up in France, and published under the sanction of the government, the substance of which we now lay before our readers. It first explains that smoke consists of volatile particles, driven off from combustible bodies, when they are suddenly exposed to an elevated temperature. These volatile particles chiefly consist of carburetted hydrogen; a gas which, although extremely combustible, requires that it should be mixed with a certain proportion of atmospheric air, and that it should be raised to a high temperature before it will burn. Either of these conditions being absent, the gas decomposes; and the carbon, one of its constituents, is deposited in minute particles in the form of soot, whilst the hydrogen is escaping at the orifice of the chimney. If we throw a quantity of fresh coal, to the thickness of some inches, upon a mass of incandescent coke, those parts of the coal which are immediately in contact with the coke undergo a sudden decomposition; the temperature of the furnace is lowered, the passage of air through the grate is obstructed, and thus the true conditions essential to the combustion of the generated gas are absent, and the result appears in volumes of opaque smoke issuing from the orifice of the chimney. The introduction of air into the furnace will not of itself be sufficient, for the temperature remains lower than is required to effect the inflammation of the gaseous products. The opacity of the smoke gradually diminishes as the coal is converted into coke by the escape of the volatile particles, as the air obtains access to the combustible matter, and as the heat of the furnace rises. If the mixture of coal and coke is agitated by a poker before the decomposition of the former is complete, the unburned parts of the coal are brought into contact with the incandescent coke, rapid decomposition ensues, and more smoke issues from the fire.

The furnaces in which the bars of the grate are so far apart that the burning matter can only be covered with a thin layer of coal, give rise to a small quantity of smoke, and a similar result takes place by feeding a furnace with a very small quantity of coal at a time. When the fresh supplies of fuel are placed in that part of the furnace which is farthest from the chimney, there will be but little smoke produced, since it will have to pass through much incandescent matter to arrive at the chimney. When the furnace is so constructed that the required quantity of fuel cannot be properly consumed in a given time, there will always be much smoke; and the stoker's mismanagement is a frequent cause of smoke. Instead of supplying a little fuel at short intervals, he usually throws on large quantities at distant intervals. Again, some kinds of coal, as is well known, produce much more smoke than others. Coke, of course, gives none. Nothing but colourless gas, with perhaps a small quantity of light ashes, issues from the chimneys of furnaces where coke is consumed.

The inventions which have for their object the consumption of smoke are very numerous. A general statement of the principles they involve must here suffice. All smoke-consuming apparatus endeavours to realise the two conditions previously mentioned, as necessary to the combustion of carburetted hydrogen, the gas evolved by the decomposition of fuel. One class of these arrangements (usually put in action by the engine which the fuel heats) seeks to supply fuel to the furnace either continuously, or at short and regular intervals. Another class comprises apparatus which is either fixed or capable of being put into action by the stoker, having for its object the introduction into the furnace of the supplies of fuel without the necessity of opening the furnace doors, thereby admitting a volume of air, and cooling the interior. Furnaces of this description are frequently furnished with openings in the door and at the sides, so constructed as to be opened or closed at pleasure; the object of which is to admit, after each charge, a sufficient quantity of air to effect its combustion. In some arrangements the fuel is introduced under that already incandescent, instead of being thrown upon the burning fuel. In this case the air meets the fresh coal immediately, and the volatile particles, having to pass through the incandescent fuel, are consumed as soon as formed.

In some contrivances more fires than one are arranged in such a manner that the smoke generated in one, is forced to pass into another furnace where the fuel has been deprived of its volatile particles. Other contrivances are simply composed of inclined grates, or of grates arranged in steps and fitted with openings furnished with valves for admitting the exterior air into the middle of the smoke and gaseous products, either continuously or at intervals. Attempts have also been made to consume smoke by forcing a current of air between the bars of the grate, or by passing a jet of steam from the boiler into a pipe, one end of which communicates with the atmosphere, and the other beneath the grate of the furnace.

Carbonic oxide, a gas which is abundantly evolved from blast furnaces, has been sometimes applied to the heating of steam boilers, mixed with a certain quantity of atmospheric air; and this mixture, when once inflamed, will burn without emitting any smoke.

In some furnaces the smoky gases are submitted to a sort of washing, by which the soot and particles of ash with which they are charged are removed. To produce this effect they are made to pass through water.

None of the above-mentioned methods for preventing smoke has been unsuccessful when the furnace has been properly constructed, and the stoker attentive to his duties. In many instances, doubtless, the attempts have failed, but examination into the circumstances would always show that the smoke-consuming apparatus had been improperly applied, or that the stoker was ignorant of his duties, or, more frequently still, that an attempt had been made to generate more steam than was intended when the apparatus was constructed.

In cases where, by reason of the smallness of the furnace, or from any other cause, a smoke-consuming apparatus is inapplicable, it is recommended that coke should be exclusively employed, and not fuel which produces smoke.

A contrivance invented by M. Duméril has attracted some attention in France, and has been favourably reported on by a committee of physicists. We take what follows from the report to which we allude:—

"In the present state of the art of burning mineral fuel, the perfect combustion of smoke is both practically and theoretically impossible, if the fuel is required to yield its maximum effect of heat. Notwithstanding the ingenuity of many of the arrangements which have been examined by us, we think there is still room for improvement, especially with the view of making the utility of the apparatus independent of the stoker. In pursuing our investigation of the phenomena of combustion, the following facts impressed themselves upon our attention. In whatever way the carburetted hydrogen is disengaged, the smoke is generated at the top of the fuel, and much carbonic acid gas is mixed with it, thus producing a compound gas, very difficult of combustion. Besides, the fresh coal thrown upon the fire absorbs, in its decomposition, a certain part of the caloric of the furnace, and the heat is insufficient to pierce the fresh layer deposited upon the fire, and to inflame the gases. Moreover, the coal thrown suddenly upon an incandescent layer is burnt too quickly, instead of being gradually decomposed. The introduction of a fresh supply of fuel is immediately followed by an enormous emission of smoke, which requires for its combustion not only a large increase of temperature, but a proportionably large volume of oxygen; whilst the supply of air is intermittent and irregular, and is, consequently, injurious to the proper action of the furnace. By the use of mechanical feeders to supply the fuel continuously, a greater quantity of air is needed than without such feeders. Whenever it is necessary to augment the power of the furnace, the regularity of the process, and the equilibrium of all the functions is destroyed. Lastly, there being almost always intermission in the operations, it appears nearly impossible to regulate the several elements of combustion with precision sufficient to maintain the requisite balance.

The solution of the problem depends on the fulfilment of several conditions: firstly, in causing the gases to originate in the vicinity of pure air; secondly, in forcing them along with atmospheric air into some part of the furnace where their temperature will be raised to the point of combustion; thirdly, in causing them to be generated, not at the top of a layer of cold and black coal, but at the top of a perfectly incandescent layer; fourthly, in regulating the quantity of each supply of fuel, so as to keep it at the point at which the generation of carbonic oxide commences; fifthly, in rendering uniform the action of the various parts of the operation, in order that additional supplies of air become unnecessary, or at any rate produce no ill effect in the furnace. The object is not to produce smoke with the view of burning it, but to prevent its generation.

The principle of the processes which we employ to solve the problem are simple. They consist in reversing the ordinary arrangement, and in placing the fuel to be burned under that which is burning, whilst the whole mass is traversed by a good draught. These two objects we have endeavoured in all our experiments to apply in practice. Our plan is to make a horn-shaped passage, gradually widening from the exterior end, to convey the fuel into the furnace. The fuel is supplied through the smaller end outside the furnace; the passage terminates at an angle of 40° in the middle of the furnace, and at its lower extremity is formed into a sort of grate. On lighting the furnace, coke is used, and afterwards coal. The combustion of a thick mass of fuel may be thus effected; carbonic oxide may be generated at will; and oxygen being admitted, a very high temperature may be reached. All the phenomena of burning are thus regular and constant. There being no intermittent action, the admission beneath the grate of an additional supply of air is advantageous. The grate being divided into three compartments, and arranged in such a manner as that the draught can be made to act upon any one, it may be directed upon either that which contains the fresh coal, or that which contains the burning coke. As the fuel is not supplied through the furnace-doors, the combustion may be considered as taking place in a closed vessel. The furnace is not opened at all, except at intervals of two or three hours, for the purpose of removing the ashes towards the centre of the furnace. In fact, by means of reversing the usual mode of adding fuel, and by the influence of a powerful draught, all the usual phenomena of combustion are reversed. The excessively high temperature which, in furnaces of the ordinary construction, is found near the grate, is, in furnaces of this construction, at the upper part. The decomposition of the fuel which has hitherto taken place at the upper part, is now in action near the grate; and the phenomena of burning are effected with regularity and continuity, notwithstanding the intermission of the charges.

We may add, that in order to allow the coal to pass fully along the passage into the furnace, we have made the passage gradually larger as it descends, so that the section of its upper extremity is to that of its lower extremity as 12 to 100."

THE SOCIETY OF ARTS.

This Society has flourished well during the past year. Having a broad and expansible basis of action, it can accommodate itself to all enlargements of skill and science, and the last twelve months of its long existence sufficiently demonstrate its progressive and progressing character. Its annual Journal lies before us—a huge leviathan, which has increased its size from a few leaves to between 800 and 900 pages, exclusive of almost as many pages of advertisements, and a full catalogue of the Seventh Exhibition of Inventions. From an institution often suffering a lingering life, and sometimes almost dead, it has sprung into renewed activity, and its old age manifests even more of youthful energy than it exhibited in by-gone years. Whether we may ascribe this to its new officers, or its new labours, or the character of those labours, or whether, as is probable, all have thoroughly blended their forces together, the Society is now evidently acting well, and, as we may say in vulgar parlance, is in full swing. We are not the only ones who do or should rejoice at this. There is scarcely a page in the volume but what speaks to the same effect, whether it be a chairman reporting progress, a lecturer laying down his peculiar laws, or an advertiser quietly publishing his beneficial inventions. Such a volume as this is a very great boon to England. If any one person could, during a long life, master the realities and truths which are here brought to light, he would become an adept in many things, and something or another oozing out from his mere knowledge might render him remarkable in all time. It is a most engaging volume. We have dwelt upon its entire contents with pleasure, and upon many portions with the greatest delight. For all is in a progressive spirit, while some point the way, and others constitute progress itself. The advertisements, illustrated for the most as they are, form authentic lines of history—of that grander kind of history too, which, from dealing with facts alone, is building up portions of the temple of true science. It is with some pride that we can refer our readers to our own pages in this respect, while, as regards inventions really useful, we ourselves prove every month the value of illustration in mechanical and artistic construction.

The reports of the lengthy papers read on Wednesday evenings make up, to a great extent, the bulk of the volume. The discussions which follow the reading of the papers are here readable with often more interest than the papers themselves, and the reporter has performed his laborious task well—giving the substance of the addresses at considerable length. The book gradually details all the proceedings connected with the Universal Exhibition at Paris, and will, in this respect alone, form a volume of reference for ever. The reports of its several meetings gradually evince how all the active members of its committees have suggested, followed out, and completed arrangements for England, and the

English standing well in the estimation of our friendly neighbours, and particularly as regards the visits of our artisans to the French capital. The subjects of the coming decimal coinage, and the coming substitute for linen in the manufacture of paper, claim no small share of space, and very properly. The newly-discovered adulteration of almost every manufactured article of food is dwelt upon in many useful papers, which we trust will have some influence in preventing it. It may indeed be but little, but every little "tells." It seems a law, that we should progress with a double refinement—the one kind drawing us back from the paths we have left, and the other surely and staidly leading us on, careless of all attempts at opposition and decay.

Among other articles of permanent interest in this volume, and which we have alluded to above, will be found the following:—A lengthy and well-written report on the Munich Industrial Exhibition of 1854, from Consul-General Ward to the Earl of Clarendon; on the manufacture and application of various products obtained from coal (coal gas excepted), by Professor F. Crace Calvert; a very important paper on some undeveloped and unappreciated articles of raw produce from different parts of the world, by Mr. P. L. Simmonds; some important papers on our iron manufactures, on flax and its products, on the British Colonial contributions to the Paris Exhibition, and divers important reports of committees, particularly those on the industrial pathology of trades, as affecting some of the senses. There are also very excellent papers on the peat and its uses; on the commercial consideration of the silkworm and its products; on sewage; on a new method of teaching drawing, involving the principle of a new system of architecture; on the diseases of miners; on the mutual relations of trade and manufactures; and on life-boats; with many papers on topics of so-called inferior, but really not less important interest.

We are glad to find the Society taking up the new subject of international commercial law. Law has been so essentially, in all nations, the creature of particular circumstances, that it is well where rules of action founded upon them, and which, as we are daily compelled to feel, survive the special reasoning upon which they were founded, give place to other rules founded upon the broader and more enduring basis of moral right. Even the most antiquated pleaders and judges are beginning to discover that improvements are absolutely necessary in our international commercial law, while, at the same time, it does not require a very far-seeing eye in the artist-manufacturer to discover or imagine means by which improvements in this particular law may be followed by improvements in his own department, which now but pass obscurely and occasionally only across the mind.

The more generally interesting proceedings of the several institutions in union form useful matter in numerous pages, and no doubt add considerable stimulus to the members of the institutions. In most of these we are glad to observe evidences of new life since the union came into operation. One of the principal efforts now making by it, is the supervision it bestows on these provincial societies. They continue largely to be taken into union, and many are the mutual benefits attendant thereon, besides the ostensible ones which are the first inducements towards it on the part of the country folk. The address of Viscount Ebrington upon the special subject, delivered at the first ordinary meeting, is well worth preserving, and furnishes, very appropriately, the leading article to the volume before us. We have already noticed this, and the principal discourses delivered and discussions at meetings, throughout our own last year's pages, so that we cannot repeat them. Everything relating to or connected with the metropolitan or provincial institutions will be found here, even to the law regulating them, or the decisions of the judges on cases coming before them. The examination and grants of diplomas to students of the classes in union with the Society of Arts, is a subject which has met, and is still meeting, with the attention it deserves, while the subjects of examination run over all departments of secular learning. The annual conferences form points *d'appui*, which, no doubt, will be creative of much beneficial emulation as well as social importance. They are a kind of intellectual fair, to which each deputy may contribute something beneficial to all the others.

The private correspondence, in general, displays talent, and, not rarely, very choice topics for thought and action, particularly to the young mechanic, who should never let these letters slip by.

As must happen with all fact-recording serial publications, these pages tell us tales of sad mortality. The past season has not, however, we are happy to say, been prolific in such bereavements, yet always any worthy to be here noticed must be considered such, beyond the sacred precincts of individual homes and nations. The scientific man is the brother and friend of all mankind.

Upon the whole, the result of the last year's work causes us to look forward with great hope, not so much as to what will take place during the current session, but as to what we are convinced must eventually be the results of such renewed activity to great purposes as the increased number of the "Fellows" displays.

One of the best things in a useful book is an extended and good Index. We wish we could say that we had such attached to the volume before us. It is tolerable, but too short.

GUNPOWDER AND OTHER EXPLOSIVE COMPOUNDS.

Dr. Gladstone recently delivered a lecture on this subject, at the Royal Institution, London, the substance of which we now lay before our readers. Any great and sudden increase of volume may give rise to the phenomena designated explosion; but such great and sudden increase never takes place by the mere dilatation of a solid or liquid body: it is always necessary that gases should be formed. The simplest form of explosion is when a liquid is suddenly converted into a gas, either by the removal of pressure, or by the bursting of the vessel in which it was contained, as illustrated by the common "candle-cracker." The enormous expansion of a gas by the removal of pressure, is taken advantage of for the projection of missiles in the air-gun, and in Perkins' steam-gun. In these cases there is no chemical change; but usually an explosion is the result of a rapid chemical action between the different constituents of a mixture, or chemical compound, by which substances are produced that ocuppy a very much larger space than the original combination did. Such an explosion is always attended with heat, and generally with light and noise. The substance exploded may be a mixture of two or more gases: for instance, if the fire-damp of the mines be set fire to in the air, it burns quietly with a luminous flame; if, however, it be previously mixed with air, on being ignited the flame passes instantly throughout the whole mass; and if mixed with twice its volume of oxygen, this takes place with great violence and a loud report. One atom of the carburetted hydrogen combines with four atoms of oxygen to form carbonic acid and water. In this case, however, the gases produced by the explosion would actually have occupied less space than the original mixed gases, and a positive contraction would have ensued, had it not been for the high temperature at which they were formed. In order to obtain very great expansion, we must not start with a gaseous mixture. Solid or liquid oxygen is a desideratum, but it can be procured in that condition only when in a state of combination. There are several salts which contain a large quantity of this element, and which give it up with great facility—the nitrates and chlorates of potash or soda, for instance; and these salts contain also another element, which when free assumes a gaseous condition even at ordinary temperatures. When wood is added to one of these salts fused by heat, violent combustion ensues, and still greater effects result when the salt and the carbonaceous matter have been previously mixed. Gunpowder, as is well known, is composed of nitre or saltpetre (nitrate of potash), charcoal, and sulphur: different countries mix these ingredients in different proportions. In exploding, gunpowder produces carbonic acid and nitrogen gases, and sulphuret of potassium, which is also dissipated by the great heat evolved, and if it reach the air is converted into sulphate of potash, giving rise to the white smoke that follows the explosion. Besides these gases, some others are always produced in small and varying quantity. By burning a fuse under water, these gases were exhibited. It is supposed that, at the moment of explosion, the heated gases occupy fully two thousand times the volume of the original powder. By mixing different combustibles with nitre, various effects may be produced on explosion; sometimes the light, sometimes the heat, and sometimes the noise being the most remarkable. When nitre was an article of scarcity in France, the French chemists made many experiments with a mixture of chlorate of potash, charcoal, and sulphur; but this compound, though a good explosive, has several disadvantages, which have prevented its ever coming into extensive use. A white gunpowder has more recently been prepared by mixing chlorate of potash with yellow prussiate of potash and sugar.

The explosives hitherto described are all mixtures. There exist substances which contain all the elements of combustion within themselves, and which require only a slight elevation of temperature, or a smart blow, to alter their state of chemical combination, and suddenly to produce gaseous bodies in large quantity. Pre-eminent among these is gun-cotton: a substance formed by immersing cotton in a mixture of nitric and sulphuric acids. It is generally allowed now that this compound consists of lignine, $C^{24} H^{20} O^{20}$, in which a portion of the hydrogen has been replaced by NO^4; difference of opinion exists as to the amount so displaced, but Dr. Gladstone had found it to be five atoms in the most explosive gun-cotton, three in that of inferior quality, which he designated cotton-xyloidine. The most explosive compound produces a sudden flash, but no smoke or loud noise, and leaves no residue whatever. Hydrocyanic acid is among the resulting gases. Nitroglycerine, a liquid produced in a similar manner from glycerine, is of so explosive a nature, that if a single drop be struck by a hammer on an anvil it gives rise to a deafening report. Its composition is $C^6\ H^5\ 3(NO^4)\ O^6$. Similar to this is nitromannite, which also explodes on percussion. Several other simple nitric acid substitution products are also capable of explosion: and so are certain salts of organic acids, which are analogous in their constitution; for instance, carbazotate of potash. Fulminating mercury and silver are also salts of an organic acid, the fulminic, which contains both oxygen and nitrogen. They explode, as is well known, by percussion, and with extreme violence. There are, however, certain detonating compounds, which contain no oxygen, nor any other supporter of combustion, but which are easily caused to undergo an internal change, and to resolve themselves into gaseous products. The most remarkable of these are certain substitution products of ammonia and the so-called ammoniurets of gold and other noble metals, and the so-called iodide and chloride of nitrogen. The iodide is a black powder, which when dry will explode on the slightest touch of a hard substance, and even sometimes by a sudden concussion of the air near it. Its composition had been examined by the speaker, and found to be always $N\ H\ I^2$. The chloride is a still more dangerous substance, since it explodes with the greatest facility under water. It is an oily liquid, the composition of which is $N^2\ H\ Cl^5$. The selection of an explosive compound will, of course, depend upon the purpose to which the explosive is to be applied. If it be merely for the production of an instantaneous flame, in order to ignite some other body, those compounds which are exploded by percussion have a great advantage. Percussion caps of various kinds were exhibited—those intended for muskets being filled with a mixture of equal parts of fulminating mercury and chlorate of potash, fixed by a varnish; those made use of for cannon, being charged with two parts of chlorate of potash, two of native sulphuret of antimony, and one of powdered glass, which last appears to be practically a beneficial ingredient, although it takes no part in the chemical action. Caps made of fulminating mercury and collodion, bronzed over, were also shown. Explosives, however, are generally intended for the projection of missiles, or for blasting. For either of these purposes, propulsive force is the grand requisite. Now most of the compounds previously described explode too rapidly, and produce a very powerful local effect. If employed in fire-arms, they would tear or strain the gun, and not propel the ball any great distance. Gunpowder, if tightly compressed, as in a fuse or a port-fire, burns comparatively slowly; the necessary rapidity of explosion is given to it by granulation; and this can be modified according as the different purposes for which it is manufactured require. Supposing an explosive to have the necessary propulsive power, a very important quality is safety—safety in the process of manufacture, and in its subsequent keeping and handling. This practically excludes the use of all those compounds which are exploded by a blow. Gunpowder requires a temperature of 600° Fahr. to ignite it; and this gives it a great advantage over gun-cotton, which is fired by a heat not much exceeding that of boiling water. The comparative difficulty of exploding gunpowder was exhibited by setting fire to some ether round about a portion of it, which remained unaffected in the middle of the large flame; and by igniting a piece of gun-cotton, without firing the little heap of powder on which it rested. Gunpowder may even be sprinkled on the top of gun-cotton, and the latter may be exploded, and cause the scattering of the black grains unaltered. It is a desideratum that the explosive should not be injured by wetting. In this respect gunpowder fails, while gun-cotton, and several of the substances previously mentioned, suffer no injury by being soaked in water and dried again. Good gunpowder, however, is not materially affected by the ordinary damp of the atmosphere. Nitrate of soda, though it contains a much larger amount by weight of gas-forming constituents, cannot be substituted for nitrate of potash in the manufacture of gunpowder, partly because the resulting mixture is hygroscopic. The complete combustion of an explosive is another desideratum. In firing cannon, a considerable portion of the charge of gunpowder is always lost, by being blown out unburnt; but this is the case to a much greater extent with gun-cotton, as was experimentally demonstrated. It is important also in respect to fire-arms, that the products of combustion should not foul or corrode the piece. Gunpowder leaves a considerable residuum, which has to be sponged out afterwards; but it is an alkaline salt, and has little effect upon metal. Gun-cotton, on the contrary, leaves no residuum; but the piece remains filled with the highly corrosive red nitrous fumes, which have an acid reaction. Cheapness is, of course, an important element in comparing the practical value of different explosives; but the calculation must be made, not according to the weight, but according to the propulsive force of the various substances.

This review of the qualities requisite in an explosive, shows that gunpowder is admirably suited to such a purpose, on account of its great propulsive power with little local strain, its great safety, both in manufacture and in use, and its cheapness. It has two disadvantages: its being spoiled if wetted, and its leaving after explosion a quantity of solid matter. It is evident, that most of the fearfully explosive substances with which chemistry has made us acquainted, are perfectly inapplicable to the projection of balls. Mixtures containing chlorate of potash, though good in some respects, are dangerous. Gun-cotton is the only substance that puts forth just now any great pretensions as a substitute for gunpowder; its propulsive force is somewhat about three times that of an equal weight of powder, and it has some other advantages, coupled, however, with serious disadvantages. The Austrian Government has lately put it very fully to the test of experiment; and that they have been to some extent satisfied of its value, is attested by the fact, that a considerable number of cannon, of great thickness of metal about the breech, have been formed expressly with the object of employing it.

It is said to be a modification of gun-cotton which is used; and the speaker thought it most probably was either a lower substitution product of cotton, or a mixture of ordinary gun-cotton with some other substance. In England, experiments have sometimes been made with this material, and it is said to have been employed with advantage for filling shells at the siege of Moultan; but, on account of the many accidents that have occurred with it, it finds little favour at present with our military authorities.

STEAM BOILER FURNACES.

By Mr. W. S. Young, *Leith.*

(*Illustrated by Plate* 185.)

The arrangements of steam boiler furnace, which we have so fully delineated in our leading plate of the month, exemplify a practically good mode of effecting the twofold object of preventing the wasteful and unpleasant discharge of unconsumed fuel in the shape of smoke, and obtaining a superior amount of work from the boiler. Mr. Young's invention is applicable to most kinds of steam boiler furnaces, whether the fires are inside or out, but it is best adapted for internal fires. Under one modification, two distinct furnaces are employed for each boiler, both of them being made to communicate with a single smoke-chamber at their inner ends. In such circumstances, the two furnaces are fired alternately, so that the thick, "green" smoke produced from the freshly applied coals in one, may be commingled with the highly-heated smokeless product of the other. The smoke-chamber is supplied with heated air by means of pipes passing through the water-spaces, and opening at one end into the smoke-chamber, whilst, at the other end, they are open to the atmosphere, or may be fitted with any suitable valvular arrangement for regulating the supply of air. In boilers where more than two furnaces are employed—as in marine boilers, for example—the furnaces may be coupled together in pairs, each pair communicating with a single smoke-chamber, the furnaces being fired alternately.

Fig. 1, on our plate 185, is a front end view, half in transverse section and half in elevation; and fig. 2 is a vertical longitudinal section of a stationary steam boiler and furnaces arranged according to Mr. Young's system. The boiler, which is cylindrical in form with flat vertical ends, is fitted with two internal furnaces, A, B. The grate bars of these furnaces extend backwards in parallel cylindrical flues as far as the bridge, C, behind which is the mixing or combustion chamber, D, for the gases. This chamber at its front or bridge-end is of sufficient width to join both furnaces, A, B, but it is conical in form, gradually diminishing in width to the line, E, where it becomes circular in transverse section, and coincides with the cylindrical flue, F, extending to the back end of the boiler, and communicating with the flues, G, surrounding the boiler, and formed in its brickwork casing, H. The gases from the two furnaces thus become commingled in the chamber, D; and to assist in effecting their thorough combustion, a supply of atmospheric air is introduced into this chamber. For this purpose, pipes, I, are passed through from the front of the boiler to the chamber, D, and these pipes being surrounded by the water in the boiler, the air entering through them is, to a certain extent, heated by the water, so as to have less tendency to reduce the temperature of the gases in the chamber, D. It is found in practice that a regular and uniform supply of atmospheric air answers the end in view sufficiently well, and if the pipes, I, are of a size justly proportionate to the requirements of the furnace, no valvular or supply regulating mechanism need be fitted to them.

A convenient mode of applying this invention to marine steam boilers is shown in figs. 3, 4, and 5 on the same plate, fig. 3 being a front end view, half in transverse section and half in elevation, fig. 4 a vertical longitudinal section, and fig. 5 a plan half in horizontal section. In these marine boilers, four furnaces, A, B, C, D, are shown, and there are two combus tion or mixing chambers, E, immediately in the rear of the bridges, F, each chamber communicating with two of the furnaces. The same routine of firing is to be observed with each pair of these furnaces as with the single pair already described. The chambers, E, become contracted as they recede, and they communicate with the upward flues, G, from which flues the gases pass back towards the front of the boiler over the furnaces through the tubes, H, finally passing off up to the funnel at I. The arrangements for supplying atmospheric air to the mixing chambers, E, are similar to those adopted in the stationary boiler already described. A series of tubes, J, are passed from the front end of the boiler through the water-spaces between and over the furnaces to the mixing chambers, E, the bridges, F, being perforated to admit the air from such tubes as open behind it. These air-tubes may be variously proportioned—either few in number, and of comparatively large transverse sectional area, or many, and of proportionally smaller transverse sectional area.

In many marine boilers, and more particularly in those fitted in screw steamers, there is not sufficient length allowed for the combustion-chamber, if arranged as in figs. 3, 4, and 5. To meet the requirements of these short boilers, Mr. Young has devised an improvement which is shown in the accompanying wood engravings—fig. 6 being a vertical longitudinal section, and fig. 7 a transverse vertical section of a short marine steam boiler. The latter figure only takes in half the boiler, or the two furnaces with their single combustion-chamber of a four-furnace boiler, the section being taken through the smoke-box at the back of the boiler. The invention is, in this case, carried out by converting the lower portion of this smoke-box into a combustion-chamber. This is effected by carrying in water-spaces between the tube-plate and the back end of the furnace flues, these water-spaces contracting the passage from the lower to the upper part of the smoke-box, and compelling the smoke and gases from the two furnaces to be commingled, as in the combustion-chambers in the arrangements previously described. The air-tubes are passed through from the front of the boiler to this combustion-chamber, as in the other examples.

Fig. 6.

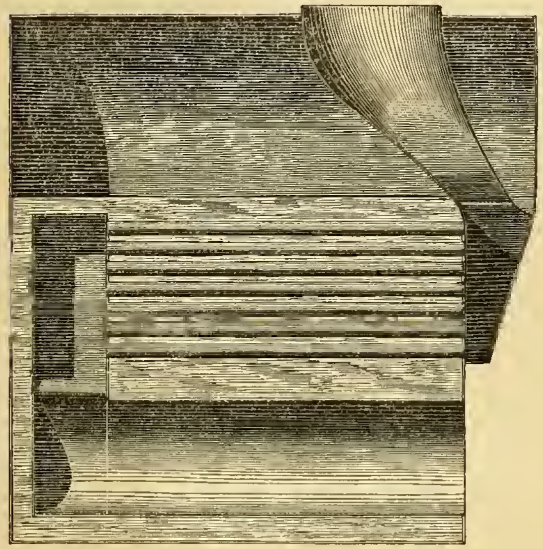
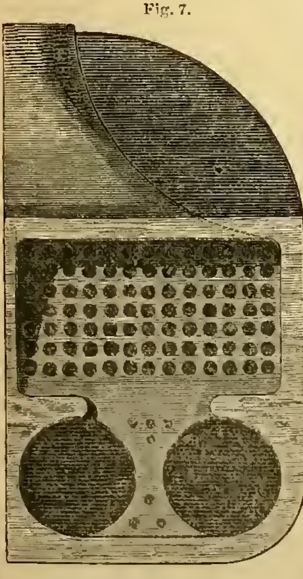


Fig. 7.



One of the chief merits of this system consists in its requiring no attention on the part of the stoker beyond the firing of the furnaces alternately, as the air supply being once adjusted requires no further regulation.

THE ATMOSPHERE.

The varied appearances presented by atmospherical phenomena have, from the earliest ages, been the subjects of wonder and admiration; but the beneficial purposes that are served by the vestment of air that encircles the globe have been seldom adverted to, though they are quite as varied as the appearances it presents, and equally as well fitted for calling forth admiration and praise.

The air we breathe is not, as was long supposed, a simple element, but consists of a combination of two gases, oxygen and nitrogen, which possess very different properties. In pure nitrogen, no plant could grow, and no animal could breathe. In undiluted oxygen, no vegetable could long exist; the vital energies of animals would be stimulated to a degree that would speedily prove their destruction, and the whole organic creation would be placed in the utmost hazard, as may easily be inferred from the fact, that, in an atmosphere so constituted, even iron itself would burn. It is also proper to remark, that when oxygen and nitrogen combine in any other proportion than that which we find in atmospheric air, they form either acids or oxides of the most corrosive kind. Nitric acid is composed of the very same elements as the air we breathe; the fumes of the one would inflict agony and death, the other is healthful and balmy.

Viewed as a part of that complicated machinery by which the general well-being of earthly things is secured, every different property that the air possesses, produces results that tend to a beneficial end.

Air, when heated, expands, and becoming specifically lighter has a tendency to ascend. This property, which is familiarly exemplified in the smoke that arises from burning fuel, performs in nature the most important effects. The air of the torrid zone, warmed by the equatorial sun, rises, in the first place, to the higher regions of the atmosphere, and then flows northward and southward to the poles; while the colder and heavier air of the polar regions is continually coming in to supply its place. By this means, the burning heat of the tropical plain is abated, and the extreme cold of the polar circles is mitigated. These currents are modified by various causes, more especially by the effect of the earth's rotation on its axis, which gives to the currents that flow from the equator to the poles a tendency towards the east, and to those that come from the poles a tendency towards the west, and thus changes what would in our latitude have been a south wind into a westerly one, and what would have been a north wind into an easterly. These currents, thus modified, are the great sources of all the varied motions that agitate the air, and equalize, in some measure, the temperature of the various regions of the globe.

A similar cause, acting on a more limited scale, produces what are called the land and sea breezes of the warmer latitudes. The influence of the solar rays on the air immediately above the land is peculiarly great, in consequence of the dry ground reflecting into the air the larger portion of the heat that falls upon it, while the rays of heat that fall upon the water are almost all absorbed. During the daytime, therefore, the ascent of the rarefied air from the land causes a current of cooler temperature to flow in from the sea, which is succeeded, during the night, by a breeze in the opposite direction.

The atmosphere has the power of dissolving and diffusing through its mass all varieties of gas and vapour. Whatever difference there may be with regard to their specific gravity, or with regard to their chemical composition, whenever two gaseous products come into contact, they intermingle and unite. The case is different as regards fluids; they do not mingle unless there be some chemical affinity between them; mercury, water, and oil, for instance, may be kept for years in the same vessel, yet no mixture take place. Why gases and vapours should be thus diffused, we cannot tell; but the effects of this diffusion are manifold and important. To it we owe the spreading abroad of those pleasant odours, which communicate so much gratification to the olfactory nerves, as well as the perception of the disagreeable scents that give us warning of the localities which we should avoid. To it, too, we more especially owe the free circulation of the carboniferous gases, on the emission and absorption of which all animal and vegetable life is dependent. The particles of carbon which constitute the largest portion of our food, are collected by the absorbent vessels of the stomach and bowels; they are conveyed by them into the veins, where they mix with the blood, and having afterwards united with the air inhaled into the lungs, are breathed forth into the atmosphere in the form of carbonic acid gas. This gas, or deteriorated air, as it is sometimes termed, is immediately diffused, and is afterwards absorbed by the leaves of plants, and becomes one of the principal sources from which every variety of vegetable life derives its nourishment and growth. Other effects of a similar kind result from the same cause. The noxious miasma of the marsh, the sulphurous vapour of the volcano, as well as the deteriorated air produced by combustion, are thus spread over the globe, and produce, when largely diluted, the most beneficial effects, while, in a more concentrated form, they would have been highly injurious.

The air, when heated, dissolves moisture, which it deposits when cooled. This is a property familiarly known; but there is one important peculiarity connected with it that is not generally adverted to. The power of absorption increases in a more rapid ratio than the temperature. Air, for instance, heated till it becomes twice as hot as it was before, will absorb more than twice the quantity of water. When, therefore, two masses or volumes of air of different temperatures are both saturated with moisture, and happen to meet and intermingle, the united mass, being reduced to a medium temperature, is unable to retain the same quantity of moisture that the component portions sustained before the union took place, and vapour is immediately deposited. To this property of absorbing and depositing moisture, according to the varieties of temperature to which the air may be exposed, we owe the refreshing shower, the gentle dew, the winter's snow, the early and the latter rain, without which the earth would be a desert, and every living thing would die.

The air is transparent and colourless. If it had not been transparent, we should have been deprived of all the pleasures and advantages of sight. Had it been only imperfectly transparent, we should have been bewildered as in a fog. Had it not been colourless—had it been violet, like the vapour of iodine, or yellow, like that of chlorine—colours could not have been distinguished. All the benefits that result from light, and from the information which it is the means of communicating, would have been utterly lost, if the air had not been formed for transmitting it freely and without change.

The air is elastic. To this we owe all the advantages that result from the sense of hearing. If the air had not been thus constituted, we should not only have lost all the pleasure that arises from musical note and harmonious chord; we should have been deprived of the only means by which we receive warning of unseen danger, and, above all, we should have been incapable of articulate speech, the easy, effective, and ever ready medium of intelligent thought.

The specific gravity of the air is small. Its weight is more than eight hundred times less than that of water. Had the weight of air been equal to that of water, the ease and pleasure of walking must have been exchanged, even in the calmest weather, for the toil and labour of wading; and the gentle breeze that softly fans our brow would have been a current far too powerful for the strength of man to resist. If the weight of the air had even been double what it now is, the violence of the wind would have been proportionately increased, and neither the works of man nor the products of vegetation could have withstood its force.

Such are some of the more remarkable properties of the air; and we now ask, to what are we to ascribe them? They are many in number, and varied in character, and all of them so important that the most injurious consequences would ensue if even one of them were altered. There seems to be no atmosphere surrounding the moon, why has the earth been so highly favoured? Can we suppose for a moment, that wonderfully adapted as all these properties are to the well-being of the terrestrial creation, they originated in chance, or some blind unreasoning principle? Can any explanation be given, but that which refers them all to the gracious counsel of a beneficent Creator?

STATIONARY CROSS-CUT SAWING MACHINE AT THE ROYAL ARSENAL, WOOLWICH.

By Messrs. John M'Dowall & Sons, *Walkinshaw Foundry, Johnstone.*

(*Illustrated by Plate* 186.)

In our illustrated article of last month on the subject of timber sawing, we detailed an ingenious invention of Mr. M'Dowall's, for effecting the periodical traverse or shift of a circular cross-cut saw, the saw disc being brought up to, and removed from its work, so that the timber requires no shifting, whilst the whole of the cutting apparatus is capable of being stowed clear away beneath the mill floor. Such an arrangement is of course intended to meet special circumstances, for there are many sawing operations wherein a stationary machine is equally well adapted for cross-cutting purposes; and we now engrave a stationary machine of reciprocatory action, also invented by Mr. M'Dowall, and erected by his firm in the laboratory of the Woolwich Arsenal.

Our Plate 186 affords three several combined views of this machine. Fig. 1 is a front elevation of the sawing apparatus, as in the act of severing a log; and figs. 2 and 3 are opposite edge views corresponding. The end of the log, A, placed to be cut, is held down to the foundation by a vertical screw-box, B, abutting against the top cross beam of the saw-framing. Motion is communicated to the saw, C, by a driving belt passed over the pulley, D, set on a short crank shaft, running in pedestal bearings on the upper part of the inclined frame pieces on the right of the machine. The driving pulley, with its counterpart loose pulley, is placed on one overhanging end of the crank shaft, and the other end carries a crank lever, E, jointed to one end of a long transverse connecting rod, F, the opposite end of which rod is similarly jointed to a longer crank lever, G, on the opposite side of the framing. This lever, G, is fast upon the end of a short shaft, oscillating in bearings upon a slide on the vertical standard pieces of the framing, and carrying a large belt pulley, H; an exactly similar pulley, I, is placed on the driving side of the machine; and these two pulleys serve to carry an endless belt, composed of two lengths of flexible steel belting, and adjustable link rod, and the saw blade. The saw, C, has its parallelism of action preserved by a pair of opposite end guides, J; a flexible steel belt is fastened to each end of the saw, at the part where the latter is set in its horizontal slides, and these two belts being respectively passed round the pulleys, H, I, they are joined to the two ends of the link rod, K, which has a box screw at its centre, to enable the tension upon the saw to be adjusted at pleasure. As the main driving pulley continuously revolves, and with it the crank lever, E, the connecting rod, F, communicates a reciprocatory action to the longer lever, G, and thus the continuous reciprocatory action of the saw is secured, just as in the "high-speed tensional sawing machine" of the same inventor, given in our Plate 123, vol. 6.

The vertical standards of the frame carry two planed slides, L, each of which has a toothed rack attached to it. The cross shaft, M, carried in bearings upon the fixed portion of the frame, has upon each end of it a spur pinion, and these two pinions gear with the toothed racks of the slides. The hand-wheel, N, affords the means of turning the shaft, M, through the intervention of a bevil wheel and pinion, so that the attendant can thus easily raise or lower the saw as his work may require. The weighted beams, O, oscillating upon studs in the tops of the pillars, P, carried on the top cross bar of the framing, act as counterbalances for the weight of the saw and slides, their outer ends being respectively connected by descending links with the adjusting slides: with this system of balancing, the labour of adjustment is very light. This machine has been for some time in full and successful operation in the Royal Arsenal.

INDIAN PATENTS.

It has long been a source of complaint on the part of British inventors, that although the principle of granting patents is so fully and satisfactorily recognised at home, the Indian legislature has hitherto been averse to granting any such privileges for the extensive country under its government. This injustice has, perhaps, been most keenly felt within the last few years, when the extension of railways in India has apparently offered so large a field to inventors and patentees of inventions applicable to railways. We are happy now to announce to our readers, that this state of things is about to be remedied by a bill which has just been introduced before the Legislative Council in India, read a second time, and referred to a committee to report thereon.

The provisions of the bill, as at present before the Indian Legislative Council, are very likely to be considerably modified before the bill passes into law, and we do not therefore consider it advisable to encumber our pages with matter that may very possibly be of no practical use. So soon as the act has passed, we shall give it in full, for the benefit of such of our readers as may contemplate the obtainment of protection for their inventions in the gigantic empire of the East.

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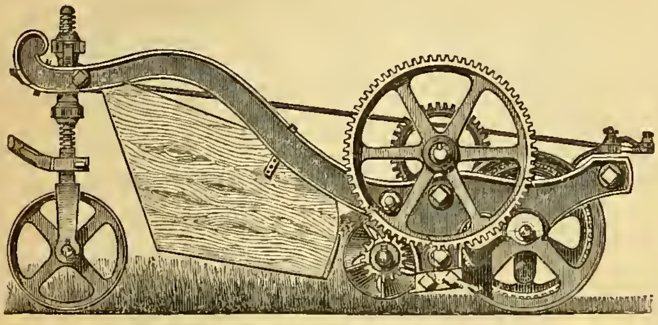
RECENT PATENTS.

LAWN MOWING MACHINE.

J. Shanks, *Arbroath.—Patent dated May* 21, 1855.

Our engraving is a side elevation of Mr. Shanks' improved mower, which is so modified and arranged as to be more convenient and effective in action, and more generally available for varieties of work, than ordinary machines of this class.

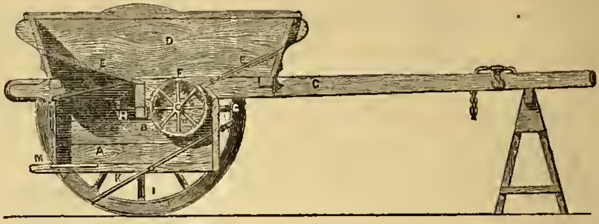
The framing of the machine consists of the two longitudinal cast-iron side pieces, connected together at their opposite ends by transverse cast-iron bars. The machine is supported on three rollers, all fixed on a single axle near the back end, and on a central guide roller at the front end. The hinder axle carries a spur-wheel, which is in gear with a pinion fast on a shaft carried in bearings on the side frame pieces. On one of the overhanging ends of the shaft is fixed a spur-wheel, which is in gear with a pinion on the cutter shaft, carried in bearings on the under sides of the frame pieces. The cutter shaft has fixed upon it a series of cutter blades, arranged helically or spirally round it, and standing out radially from it. These blades cut the grass, acting in combination with the edge of a plate, which is bolted to downward projecting portions of the frame pieces. A shield or drum is placed round the cutting blades, and at a short distance from them, to guide the severed ends of grass into the receptacle where they are thrown by the rotatory action of the cutting blades. This receptacle is a wooden box, occupying the front portion of the machine, and slung from the side frame pieces by metal straps or staples. When it is necessary to traverse the machine without mowing, the cutter shaft is thrown out of gear by withdrawing a clutch connected to one of the carrying rollers. The clutch is shifted into or out of gear by means of the bell crank lever, carried upon a stud pin upon the back transverse bar of the framing, this lever being worked by a rod which passes to the front end of the machine. The front supporting and guiding roller turns on a spindle carried by the forked support, the upper portion of which is screwed, and passes through an eye in the front transverse frame piece. A pair of nuts are passed upon the screwed portion of the support, one below the frame piece and the other above it, and by slackening one nut, and screwing up the other, the support may be made to elevate or depress the front end of the machine, and to cause the mowing cut to take place proportionately high or low. The portion of the support below the screwed part is squared, and the forked end of the traction rod is passed upon it, and secured by a key at the back. The support is capable of swivelling in the eye or socket in the frame piece, so that, on turning the traction rod in either direction, the wheel will turn to one side, and so guide the machine out of the straight line when required.



TURNIP-CUTTING CART.

Caldow & M'Kinnel, *Dumfries.—Patent dated July* 12, 1855.

This cart is fitted up with apparatus for cutting, slicing, or pulping turnips and other vegetables during the actual traverse of the cart over the ground. Our engraving is a longitudinal vertical section of a turnip-cutting cart, as constructed according to this invention. Externally, the cart resembles an ordinary box farm cart, except that it is formed with a box or chamber, A, below the axle, B, and shaft, C. The upper space, D, of the cart is formed with inclined gratings, E, at its front and back portions, a central space between the gratings admitting the turnips or other roots, which are placed in the space, D, to the cutting cylinders, F. These cylinders are fast upon a transverse shaft, one end of which projects through the side of the cart, and carries an external pinion, G, which is in gear with a ring of spur teeth, H, fast on the nave of one of the running wheels, I. Various kinds of cutting or reducing instruments may be used, that represented in the drawing being of the kind known as "Gardner's Patent." A clutch, actuated by the lever, J, is provided for putting the pinion, G, into or out of gear, so that the cart may be made to traverse without the cutters operating, or they may be made to cut at pleasure. The bottom of the lower chamber or box, A, is formed with a swivelling door, K, which, when turned upon its centres into its open position by a lever, L, forms an inclined plane, down which the cut roots descend, being distributed upon the ground as the cart proceeds. The chamber or box, A, is also provided with a hung door, M, at the back, through which the roots can be removed when they may have been retained in the chamber, instead of being deposited upon the ground.

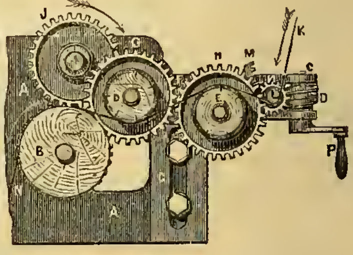


CLOTH BREADTHENER FOR PRINTING MACHINES.

J. Kay, *Bonhill, Dumbartonshire.—Patent dated April* 18, 1855.

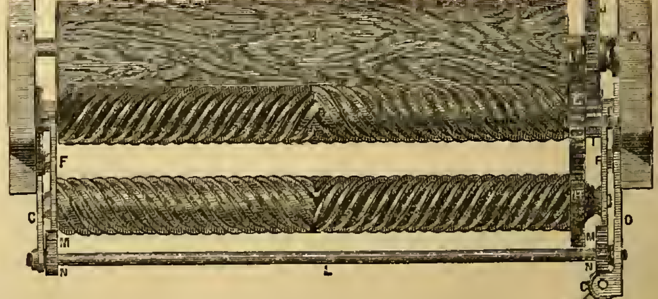
Of our engravings, fig. 1 is a vertical section, and fig. 2 is a plan, of the improved breadthener to which this patent refers. The apparatus is shown as fitted upon a calico-printing machine, a sufficient portion only of the framing of the latter being shown for carrying this apparatus.

Fig. 1.



A is a portion of the framing of the printing machine, and in bearings in this framing is carried the usual blanket roller, B. Upon the framing, A, are carried the additional frame-pieces or brackets, C, which serve to support the stretching and smoothing mechanism. It is, however, obvious that the framing of the printing machine may be constructed at first with the necessary parts for carrying the stretching and smoothing mechanism, without its being necessary to fit on additional brackets, as when the improved apparatus is to be applied to an old printing machine. The frame-pieces or brackets, C, are formed with bearings for one of the stretching and smoothing rollers, D. The other stretching and smoothing roller, E, is carried in bearings in a pair of lever frame-pieces, F, fitted with eyes upon the spindles of the roller, D, so as to turn upon these spindles. The two rollers, D and E, are parallel to each other, and are geared together by the spur-wheels, G, H, upon their respective spindles, the two rollers being always kept in gear

Fig. 2.



notwithstanding any raising or lowering of the outer one, E, by the levers, F, which cause the movement to take place round the roller, D, as an axis. The spindle of the roller, D, also carries a pinion, I, by means of which this roller is driven, the pinion being in gear with an intermediate spur-wheel, J, loose upon a stud-pin in the framing and gearing, with a spur-wheel fast on the spindle of the blanket roller, B. The rollers, D and E, are formed with blades of copper, or other suitable material, arranged helically upon their surfaces, and running in opposite directions on each half of each roller, the opposite sets of helices uniting and forming angles at the longitudinal centres of the rollers, as clearly indicated in the figure. The fabric, K, first passes under the spindle, L, then over the outer roller, E, and afterwards under the inner roller, D, to the blanket roller, B. The rollers, D and E, are driven in the opposite direction to that of the fabric's traverse, so that the fabric is submitted to the thorough smoothing and stretching action of the helical or inclined blades of the rollers, D and E; the latter acting on the under side, and the former on the upper side of the cloth.

It will be obvious to the practical man, that the severity or completeness of the smoothing action will depend upon the inclination of the fabric in entering and in leaving the helical-bladed rollers, or upon the length of contact between the fabric and these rollers; and it is for adjusting this action to suit the requirements of the fabric which is being acted upon, that the outer roller, E, is made capable of being raised or lowered, by turning its carrying levers, F, about the spindles of the roller, D, as already described. To effect this adjustment with facility and precision, the levers, F, are formed with segmental racks, M, upon their extremities; and into these racks gear a pair of pinions, N, fast on the spindle, L. This spindle turns in bearings in the frame-pieces, C, and also acts as a stay for their overhanging extremities, and as a guide to the fabric, K, as it enters the apparatus. One of the pinions, N, is also in gear with a worm wheel, O, carried in bearings in one of the frame-pieces, C, and furnished with a handle, P. By turning this handle, the pinions, N, are made to act in concert upon the levers, F, and to raise or lower them as may be required, the outer roller, E, being thereby elevated or depressed, so as to cause the fabric to remain in contact with the surfaces of the rollers, D and E, more or less, as may be requisite.

To aid in the cleaning effect of the helical-bladed rollers, D, E, the spaces between the helical blades in the roller surfaces are furnished with bristles, so as to brush the fabric as it passes in contact with the rollers. In the accompanying engravings, however, the bristles, or brushing details, are omitted, to render the arrangement of the blades clear and distinct.

This invention, or a modification thereof, is also applicable for preparing textile fabrics prior to drying them, and prior to beaming or winding on. By fitting up printing machines in this way, the printing action is greatly improved, inasmuch as the fabric to be printed is submitted to the action of the printing cylinders in an evenly stretched and cleansed condition.

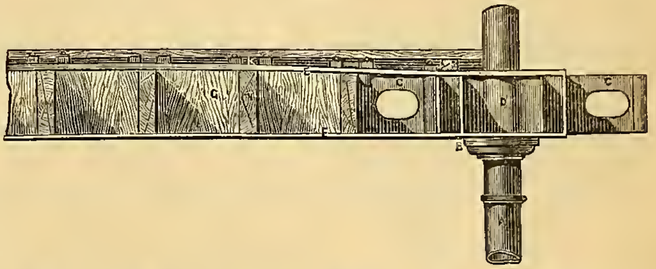
COMPOSITE BEAMS OR GIRDERS.

R. M'Connel, *Glasgow.—Patent dated May* 14, 1855.

In making a flooring beam according to this invention, two thin bars or plates of malleable iron are used as the top and bottom plates of the beam. These two plates or bars are disposed parallel to each other, and at some considerable distance asunder—one foot, for example, more or less, according to circumstances. The space between these plates is filled in with short blocks of wood, disposed with slight spaces between each block, for the reception of the flooring joists. These blocks, or pieces of wood, are disposed with the fibre of the wood in a vertical position; that is to say, in the direction in which the wood grows. When so packed in with wood, the two plates are bolted together at suitable intervals asunder by bolts, so as to bind the whole of the details into one solid beam. The wood having no appreciable shrinkage in the direction of its fibres, the beam always remains solid, whilst the direction in which the fibres are opposed to the strain from the flooring is most favourable in point of resisting strength. Cast-iron may be used instead of malleable plates for the top and bottom portions of the beam; or one plate may be of cast-iron, and the other of malleable iron. In a slight modification of this arrangement of beam, cast or malleable iron distending pieces may be used for interposition between the two main plates. Where the two main plates are of malleable iron, open diagonal or other shaped castings may be used as the supporting or distending blocks, these castings being bolted up into position just as in the case of the wood blocks. Instead of being separate and detached blocks, the distending or stay pieces may be cast as projections upon one of the main plates or bars, the other plate being then bolted up. In any of these modifications, the main plates need not necessarily be parallel, as by using deeper blocks or stays towards the longitudinal centre of the beam, increased strength is secured. The top plate, too, may be in two or more lengths, with the junction ends abutting, or nearly so. A central key may then be driven in horizontally between these ends, so as to give a rise to the beam's central portion.

Fig. 1 of the engravings is an elevation, and fig. 2 is a plan, of a beam or girder, constructed according to one modification of the present invention. The cast-iron columns, A, are formed with the usual neck and shoulder, B, for supporting the beam or girder. This beam is attached to the wings, or bracket arms, C, of the box or saddle pieces, D, which are passed upon the necks of the columns, and rest upon the shoulders, B. It is not necessary, however, to bolt or fix the beam or girder to the walls or to columns, as they may be made to simply rest with their ends in or upon the walls, or upon shoulders, or resting surfaces, formed upon the columns. The beam is formed of two malleable iron bars, straps, or narrow plates, E, F, bolted respectively to the upper and under edges of the wings, C, the lower strap, F, being slightly broader than the upper one, E. The straps, E, F, are distended or kept apart by blocks of wood, G, which are placed with the grain running in a vertical direction, small spaces being left between each block for the passage through of the transverse joists, H. The blocks, G, are made slightly deeper towards the centre of the beam, so as to give a slight rise or arch to the upper strap, E. The beam is bound up into a compact mass by bolts, K, passed from one strap to the other through the blocks, G, and on each side of the joists, H. The upper strap, E, is divided at or near its longitudinal centre, and a key, L, is inserted, by means of which the top strap may be forced to take any required arch or rise, and thus add to the strength of the beam. The employment of the key also admits of the girder being set up, if it should sink at all after being in use any time.

Fig. 1.



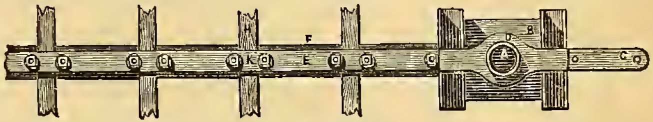
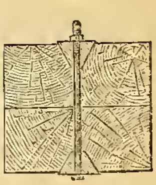


Fig. 2.

Fig. 3.



In figs. 3 and 4 is represented an improved form of washer, to be used in bolting together pieces of timber, and designed to prevent the loosening of the bolt from shrinkage in the wood. Fig. 3 is a section through two pieces of wood bolted together, and with one of the improved washers at each extremity of the bolt; and fig. 4 is a face view of the washer, showing its oval or flattened form. The improved washer is in the form of a truncated cone, with an oval base, the narrow end of the cone being entered into a recess formed in the wood; so that when the wood shrinks, as it does so across the breadth of the wood, as well as across its thickness, it does not leave the washer, as in the case of the common flat washer, but merely clips it at a point a little nearer to its narrow end.

Fig. 4.

RAILWAY TELEGRAPHS.

J. H. Johnson, *London and Glasgow.*—(G. Bonelli, *Turin.*)
Patent dated January 25, 1855.

The Chevalier Bonelli, the director-general of Sardinian telegraphs, provides in this invention a means whereby one or more trains or locomotives, whether stationary or in motion, can correspond with a telegraph station, with a pointsman or other official, or with another train or engine.

In carrying out this invention, an insulated conducting bar is, according to one modification, laid down centrally between the two rails, as shown in fig. 1 of our engravings. This figure, however, is a transverse section of the line at a level road crossing, the spaces between the rails being fitted up by brickwork, or otherwise, to a level with the rails. The central electrical conducting bar does not reach quite up to this level, so that carts or other vehicles crossing the line do not touch it. The conducting bar is supported upon chairs of porcelain or other suitable non-conducting material, which are fixed at intervals to the transverse sleepers supporting the rail. The conducting bar is coated with tar or some bituminous insulating substance, with the exception of the top edge, which is left bare for effecting the necessary metallic contact with the communicating apparatus carried by the train or engine. This communicator is shown in fig. 2. It consists of a central metal leg, with a species of flanged shoe-piece for keeping it upon the conducting bar, and it has two arms, which carry rubbers for cleaning the rail as the engine advances. This communicator is carried loosely in an insulated bracket upon the locomotive, in such a manner as to descend upon the rail by its own weight. This communicator is connected to one of the wires of a single-needle electric telegraph apparatus, the other wire thereof communicating with the earth, either through the wheels of the locomotive, or by means of a piece of metal sliding upon one of the rails. By this means, telegraphic communications may be transmitted from one locomotive to another on the same line of rails, a complete circuit being formed through the conducting bar, through the apparatus on each of the locomotives, and through the earth. The driver of each locomotive can thus communicate his exact position to the driver of another. The conducting bar may also be made to communicate with the various telegraph stations along the line, so that the positions of the trains or locomotives can at any time be made known at these points. In case the line is obstructed at any time when there is no apparatus for transmitting the telegraphic signals along the conducting bar, a bar of iron may be laid upon the conducting bar, so as to be in contact with one of the rails. This will complete the circuit, and, by deflecting the needle, will warn any approaching locomotive driver of the obstruction. Where double lines of rails are used, a single conducting bar may be laid down in the central space between the two pairs of rails, in which case the communicators carried by the locomotives must be arranged to touch the side, and not the top of the conducting bar, so that trains passing in opposite directions may cross each other without the interference of the communicators one with another.

Fig. 1.

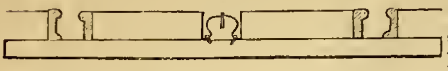
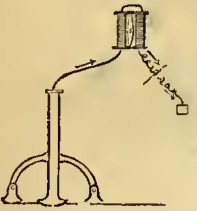


Fig. 2.



The Chevalier proposes to adopt his system of conducting bar or wire, laid near the surface of the ground in the manner described, instead of the ordinary arrangement of wires on lofty poles, for general electro-telegraphic purposes, on account of its superior economy.

PRESERVING MEATS.

Blumenthal & Chollet, *Paris.—Patent dated December* 7, 1854.

The mode of preserving meat by dessication has long been known, but it has not been brought into general use, as, in consequence of the meat being dried in pieces, whether the drying be effected *in vacuo* or by means of hot air, it does not present all the conditions necessary to effect a good and long preservation, by reason of the drying being imperfect and incomplete. The meat retains a certain amount of moisture internally, which will eventually cause decomposition to take place.

By grating or otherwise reducing the meat previously dried in small pieces, the patentees obtain a powder, which, on being submitted to a second drying process, is completely deprived of moisture. This mode of preparation, without interfering with the nutritive qualities and original flavour of the meat, has the advantage of considerably reducing its bulk by the subsequent compression to which it is subjected, whereby it is rendered much more easy of transport. The patentees also submit spices and seasoning of all kinds to the same treatment, viz., first drying and then reducing to powder, which powder is again thoroughly dried. They also propose to combine meat powder with vegetable tablets by compression, so as to obtain a single product, which may be termed compound meat and vegetable tablettes. In place of simply preparing the preserved vegetables in combination with the lean portions of meat, it is proposed to combine them with fat in the following manner:—The vegetable tablettes, prepared in the ordinary manner, are submitted to successive immersions in soup, allowing them to dry after each immersion, either by artificial or natural currents of air. There is then formed over the tablettes a layer of concentrated soup, which layer, of course, varies in thickness according to the number of immersions to which the tablettes have been subjected. This covering, when properly dried, forms an even coat over the entire tablette, so that other coverings of lead or paper may be dispensed with. When the tablettes are to be used, the covering can be easily dissolved in warm water, which is thus converted into soup. These improvements are of great importance in the preservation of vegetable tablettes, as the tablettes thus prepared contain in themselves all that is necessary for a meal, and all further cooking is dispensed with. These tablettes, which may be made of any nutritive preserved substance, which is a very important peculiarity, may be made of any size, or of any number packed together as may be required, and form an entirely new article of food.

MOULDING RAILWAY CHAIRS.

M. A. Muir, *Glasgow.—Patent dated April* 24, 1855.

This patent covers various modes of arranging and constructing the moulds used in casting railway chairs, whereby superior accuracy is secured in the form of the finished chairs, together with simplicity in the details of the moulding apparatus and process. Fig. 1 of our engravings is a transverse vertical section of one flask of a mould box for moulding two railway chairs, the pattern chairs being shown inside, as vertically sectioned, in each case, through one of their spike holes. Fig. 2 is a plan of the two patterns, and fig. 3 is a plan of the supporting saddle-piece as inverted. In this modification, two railway chair patterns, A, are placed upon the sole or "parting" plate, B, of the flask, the sand or mould material being rammed upon them in the usual way, to form the under flask of the mould. The portions of these patterns corresponding to the open jaws for receiving the rails of the finished chairs are filled up, the actual jaw openings being formed in the casting by means of metal cores, which are inserted into the mould after the patterns, A, are taken out. Upon the tops of the patterns, A, at the parts corresponding to the open jaws, and across from one pattern to the other, is placed a cast-iron saddle-piece, C, which remains in and forms part of the mould. This saddle-piece, C, is formed with a central flanged portion, D, projecting down between the two pattern chairs, A, and each of the faces of this projecting piece, in contact with the sides of the chair patterns, A, is formed with a raised feather, E. A recess is, of course, made in each chair pattern to receive this feather, but its chief use is to support the metal core when this is inserted after the withdrawal of the pattern from the mould. The core piece is represented in side and front elevation at F and G in fig. 6, and is formed with a lateral recess, H, fitting upon the feather, E, on the saddle-piece, C. The feathers and recesses may respectively be either on the saddle-piece or on the core, and they may either be on the side or top of the core, and corresponding parts of the saddle-piece, as already mentioned. At I is placed the small

Fig. 1.

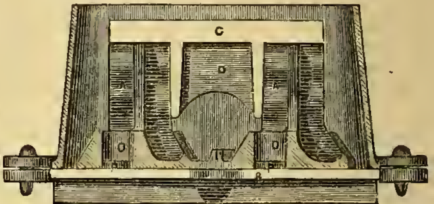


Fig. 2.

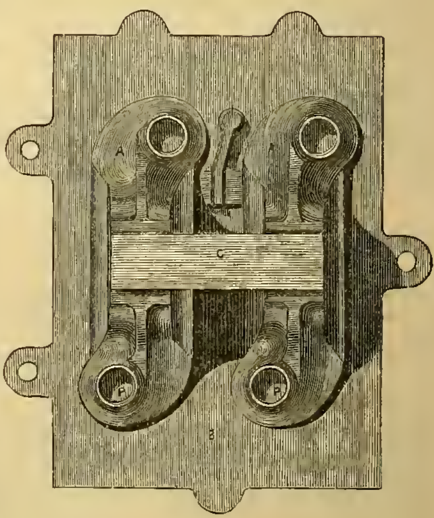
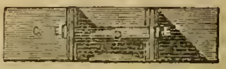
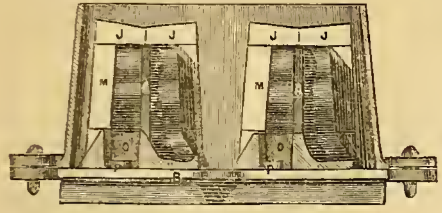


Fig. 3.



metal pattern which forms the continuation of the "gate," by which the molten metal enters the mould. According to the modification represented in transverse vertical section in fig. 4, four separate supporting and chilling pieces, J, two to each chair pattern, A, are used, instead of the saddle-piece. Each pair meets at the centre of the top of its chair pattern, upon the portion corresponding to the open jaw, and each piece is formed with sides, M, the bases of which are extended as at N, to act with a slightly chilling effect upon the portion of the sole of the chair between the jaws, whilst upon the sides, M, are feathers, E, which enter the recesses, H, in the core, and determine the exact position of this last. In both these modifications, the core, when placed in the mould, rests upon the cast-iron pieces, instead of upon sand, as in ordinary moulds.

Fig. 4.



The spike holes, O, are made completely through the pattern chairs, as shown in figs. 1 and 4; but small button-like projections, P, formed or fixed upon the sole plate, B, enter the under sides of the holes, O, and prevent the sand from being rammed completely through the pattern, serving also to steady the pattern upon the plate. From the point where the projections, P, reach, the holes are tapered upwards, being widest at their tops. The under portions of the spike holes are formed, according to one plan, by making recesses in the plate, B, upon which the upper flask of the mould is rammed. This plate has also recesses, where the metal of the sole of the chair is to be thinner, and where the manufacturer's marks are placed. Thus, when the sand or mould material is rammed upon the plate, projections will be formed upon this part of the mould corresponding to the recesses, and when the two flasks of the mould are put together, these projections will just meet the parts of the mould formed by ramming into the holes, O, in the pattern chair. The recesses are formed with rounded edges, so as to give this form to the holes in the finished chair. According to another plan, the bottoms of the spike holes, O, are formed by means of small metal cores, which are formed with central projections, and the buttons, P, on the plate, B, must have similar projections to form recesses in the sand rammed into the holes, so that, when the cores are laid upon the sand projections, their projections will enter the recesses in the sand, and insure their being placed concentrically, and with accuracy.

MOULDING HOLLOW METAL WARE.

Inglis & Cowie, *Glasgow.—Patent dated July* 4, 1855.

This invention has more particular reference to the manufacture of what are known in the trade as "cast-iron pots," whilst it is at the same time applicable to the manufacture of all vessels and objects, or articles of cast metal, which are of such a shape as to present hollow or undercut parts. The kind of pots more particularly referred to is somewhat spherical in shape, being narrower at the neck than in the body; and in making moulds for casting such pots, it has hitherto been the practice to take a pattern which is an accurate counterpart of the pot, both in thickness and in internal and external contour; this pattern, which is in two halves, being placed in a mould-box, the sand or loam is rammed upon the outside of it; the box is then turned, and sand or loam is rammed on the inside; the box is finally re-turned to its original position, and its upper and lateral pieces are separated in order to remove the pattern. Now, instead of this practically inaccurate process, the system adopted, according to the present invention, consists in preparing two distinct patterns in metal, or any other suitable material, and in ramming the sand or loam into or upon these patterns separately. One pattern is shaped to the internal contour of the pot to be cast, and being in two pieces, is removed from the sand or loam when this has been rammed into it. The other pattern is shaped to the external contour of the pot, being as much larger than the internal space in the other pattern as corresponds to the thickness of metal to be given to the pot or article which is being moulded. The sand or loam is rammed upon the second pattern in a box which is in two or more pieces, so that the box can be separated from the pattern, the pattern remaining stationary. The patterns and boxes are shaped so as to form counterpart projections or ridges, and recesses, in the "parting" surfaces, so that, when the two portions of the boxes and moulds are put together, the projections in the one part will enter the counterpart recesses in the other, and an accurate coincidence of the two parts will be thus secured. When the pots or articles to be moulded are shaped so that the diameter at the neck or brim is larger than the diameter at or near the bottom, the same process is adopted, but it may not be necessary to separate the pattern or box into two lateral pieces.

Fig. 1.

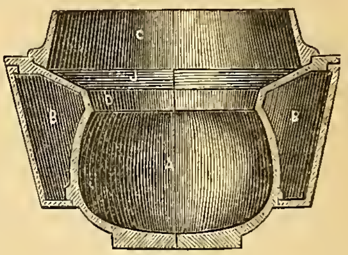


Fig. 2.

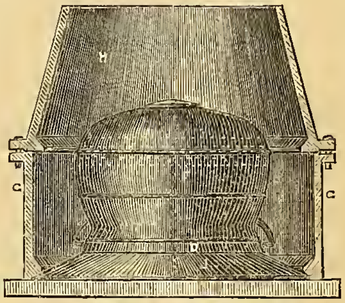


Fig. 1 of the engravings is a vertical section of the pattern and box with which the core or central part of the mould of a spherical pot is formed; and fig. 2 is a vertical section of the box, with the pattern for forming the external part of the mould. The pattern, A, for forming the core part of the mould for the interior of the spherical pot is in two pieces, being made of metal or other suitable material, and being turned, or otherwise brought to a smooth surface upon its inside. When the core is to be formed, the pattern, A, is placed in a ring, B, which being fitted to it, keeps the two halves together, and a box, C, is then placed upon the top to serve as a support for the core when it is inverted and the pattern is removed. The portion of the pattern, A, which corresponds to the actual pot, only extends up to the line, D, the conical surface, J, above it, serving to form the "parting," or part of the core which is placed in contact with the external part of the mould when the mould is put together, and a check or stepped guiding surface is turned upon the pattern at the outer edge of the conical surface, J, such check fitting a corresponding reverse check formed in the box, C. The parts being put together as in fig 1, the sand or loam is rammed into the pattern, A, after which the latter is inverted, and the ring, B, is lifted off it, so as to allow its two halves to be removed laterally, leaving the core, E, upon its supporting box, C. The external portion of the mould is made in the box represented in fig. 2, upon a pattern, F, formed to the exact shape of the outside of the pot to be produced. This pattern, F, is as much larger than the internal space of the pattern, A, as corresponds to the thickness to be given to the metal of the pot. The mould-box is in three pieces, namely, two lower semi-cylindrical portions, G, and a conical piece, H, which fits upon the top of these. The lower pieces, G, are formed with division pieces, I, to enable them to separate and remove the two halves of the lower portion of the mould from the pattern. The pattern, F, is formed with a conical base, J, extending beyond the brim-line, D, of the pot, and this forms a conical surface in the mould, which exactly fits upon the conical base, J, of the core, whilst a check or stepped guiding surface is turned in the pattern at the outer edge of the conical surface, J, to fit a corresponding reverse check formed upon the lower edge of the box, G, and also fitting the check formed upon the rim of the box, C, this arrangement insuring the concentric disposition of the two parts of the mould when brought together. The cavities in the mould for forming the feet and handles are formed in the usual way, by inserting separate patterns.

The patentees further describe the arrangement and formation of the moulds of articles of other forms on the same general system.

ARTIFICIAL OXIDE OF MANGANESE.

C. T. Dunlop, *Glasgow.—Patent dated May* 31, 1855.

An artificial oxide of manganese, well suited for the production of chlorine, is by this invention prepared from the residuum obtained in the manufacture of chlorine. This residuum, consisting of chloride of manganese, is first transformed into a carbonate of manganese by the agency of any of the means already well known to chemists, and is then subjected to the action of heat, in contact with atmospheric air. Whatever impurity the chloride of manganese may contain—as chloride of iron, for instance—is first separated either by calcination, or by the agency of a suitable precipitant. Practical working has decided that the carbonate of manganese thus treated, yields an oxide of manganese of a richness equivalent to about 80 per cent. of pure peroxide.

The carbonate of manganese may be obtained by precipitation from the chloride of manganese by the agency of carbonate of ammonia. The muriate of ammonia resulting from this treatment may either be sold or employed as such; or it may be transformed into a carbonate in the usual way, and then again employed for the precipitation of fresh chloride of manganese. Hydrate of lime is also employed in the production of carbonate of manganese from these residual matters, the hydrated oxide of manganese thus obtained being subsequently transformed into carbonate of manganese by the transmission through it of carbonic acid.

By another process, carbonate of manganese is obtained by passing carbonic acid through the solution of chloride of manganese, which has been previously mixed with a quantity of carbonate of lime. The carbonate of lime, under the influence of the carbonic acid, decomposes the chloride of manganese into carbonate of manganese, from which latter substance the oxide of manganese can be obtained as well as chloride of calcium, which remains in solution. The production of oxide of manganese, suitable for the obtainment of chlorine, has been often attempted by following the process of precipitating the manganese as an oxide, and then bringing it to a higher state of oxidation by heating it in contact with atmospheric air, as well as by other means. But the essential feature of the present invention is the production of oxide of manganese from the residuum of the chlorine manufacture, by first manufacturing or producing the carbonate of manganese, and then heating the carbonate in contact with atmospheric air.

REVIEWS OF NEW BOOKS.

Description of New or Improved Instruments for Navigation and Astronomy. By C. Piazzi Smyth, Astronomer-Royal for Scotland. Pp. 30. Edinburgh: 1855.

The first line—"Paris Universal Exposition of 1855"—imprinted on the title page of this little book, although forming in reality no part of the title itself, explains the origin of the author's handiwork. Not contented with the mere exhibition of the implements of his art, Professor Smyth has devoted his well-known talents to the detailed elucidation of his contributions in a form of general accessibility. The book then holds the character of a scientific catalogue of four chapters—"Instruments of Navigation; instruments of Nautical Astronomy; instruments of Terrestrial Astronomy; instruments of Cosmical Astronomy"—so that distant observers have thus the opportunity of mastering the complexities of this Edinburgh collection of the mechanical aids to science.

The several instruments have been, for the most part, very recently devised: hence the author comes before us with the charm of novelty, in addition to the interest attaching to the intrinsic value of the apparatus in hand.

The leading instrument in the first section of the work is the "Hemispherical Float-Log," on which the author thus remarks:—

> "We find that the motion of a ship through the water is generally measured either by the 'log line,' or by a cumulative instrument, where the first mover, or the part on which the water acts, is a wheel with inclined vanes.
>
> "Now, while the log line certainly has the advantage of allowing its accuracy to be readily tested at any time and in any place, and its zeros ascertained, (a feature essential to the character of all scientific instruments,) yet it has the disadvantage of giving a result for only a single instant, while the total motion of the vessel through a considerable portion of time is the quantity required.
>
> "The cumulative log, on the other hand, does sum up the whole of such motion, but when the prime mover is a wheel with inclined vanes, as in Massey's log, Whewell's anemometer, and Woltmann's tachometer, it has the serious drawback of not admitting of any practical mode by which the sailor may test the value of the revolutions. A slight accident, too, altering the angles of the vanes by a quantity not readily visible, may produce a great effect on the accuracy of the numbers. And I have in fact been told by my friend Mr. Alan Stevenson, C.E., that when using such an instrument on shore for measuring the velocity of rivers, he had found it necessary continually to test the value of the revolutions, and was almost daily obliged to correct for seemingly anomalous alterations. And he even adds, that a fit stream for trying the experiment can seldom be found; for the corrections proceed upon an assumption which is manifestly untrue, viz., that the stream whose course is made the measure of the distance indicated by a revolution of the vane, has, throughout that portion of its journey, a constant velocity.
>
> "The 'hemispherical-float' log, now exhibited, combines, however, the advantages of both species of instruments; for while it has all the cumulative property in full, it is actuated by a motor, the numerical value of whose revolutions is not readily disturbed, and can easily be ascertained at any time by simple measurement.
>
> "This motor, consisting of hemispherical floats on the spokes of a horizontal wheel, was first employed by Cavendish, and to measure streams of air. But its memory seems to have been well-nigh lost, until, independently discovered, it was again introduced to the scientific world by Mr. Edgeworth, and had its peculiar qualities demonstrated as an anemometer, by the Rev. Dr. Robinson of Armagh. Since then the form has been employed by many persons, and it is only the successful application of it as a ship's log and a water-meter, which is the novelty of the present case.
>
> "To determine the value of the revolutions, we have merely to measure, with an ordinary divided scale, the distance of the centre of each hemisphere from the centre of the wheel. The circumference of such circle will then give the space moved through by the revolving hemispheres in one revolution; and *three* times that space, if the friction be reasonably small, and the hemispheres have by no accident been visibly flattened, will be the space moved through by the whole machine, or by the water flowing over it. This triple proportion results from the difference of fluid pressure on the concave and convex sides of the hemispheres, and is constant for all velocities.
>
> "This form of motor having been approved of in the severest trials, as a measurer of streams of air, must, *a fortiori*, be capable of accurately measuring streams of water. Accordingly, the present machine has been lately found in Scotland to give excellent results, whether employed in gauging rivers, or as a log for vessels in motion."

The same principle is also carried out in the author's "Vertical Depth Measurer," so as to obviate the chances of error from the motion of the ship drawing the line of a simple weight to an extreme angle. The other three chapters of this section, on an "Electric Velocity Anemometer" for ascertaining the velocity of the wind at sea; an "Electric Direction Anemometer" for giving the direction of the wind, and, on "constructing scales," will well bear the critical examination of the nautical man. Amongst the "Instruments of Terrestrial Astronomy" we find the following on "Safety Levels," and "Spontaneous Levelling Instruments:"—

> "Spirit-levels may be said to be more or less *sensible*, according to the quickness with which the air-bubble moves to a new position, on a change of inclination being given to the tube. Keeping then this definition clearly in view, and separating the *sensibility* from the *quantity* of motion, which depends on the radius of curvature of the glass, I find that levels filled with chloroform are even more sensible than those with the best ethers, as the sulphuric and the nitric; and in applying the hermetically sealing process, they have besides the advantage of the liquid not being inflammable.
>
> "But with all these fluids of a low boiling temperature, there is such an excessive expansion of bulk at the higher atmospheric temperatures, that if, under such circumstances, there be left any sensible size of air-bubble, it will expand so prodigiously at a lower temperature, from the contraction of the fluid, as to extend along the whole length of the tube, and so prevent any readings being obtained. On the other hand, if the bubble be made of a moderate length in cold, then in hot weather, the fluid expanding itself, and compressing, or absorbing the air, will burst the glass.
>
> "Against such inconveniencies the present 'safety-levels' are intended to guard, and thus: a diaphragm, pierced at its centre by a small tubular passage, is inserted towards one end of the glass, forming that end into a chamber which is nearly half filled with air. This large supply is capable of accommodating any amount of expansion of the fluid of both sides of the diaphragm. The space on the further side, which is graduated for observation, contains only a moderate sized air-bubble, which keeps comparatively constant dimensions; for the expanding fluid finds its way very readily into the attached chamber, where the air space is abundantly large.
>
> "In that most useful and extensively practised operation of 'levelling,' the greater part of the time of the observer is occupied in adjusting the level-bubble, and consequently the spider-lines of the telescope; and on the perfection of such adjustment depends all the accuracy of the level lines obtained. And a most irksome operation all who have tried it, will confess it to be, even although a ball and socket, and a spherical level on Mr. T. Stevenson's plan, be used for getting an approximate position of the tube.
>
> "But by employing one of the 'spontaneous horizon-points reinforced,' no adjustment at all is needed, nor are even any wires required in the telescope. We have merely to look with a common opera-glass partly into the horizon-point, and partly to the country beyond, and may then see, in some part or other of the optical field, the floating form of the little circular bubble, indicating exactly, by its centre on the distant landscape, or on a levelling-staff appropriately placed, the height of the horizon.
>
> "The present instrument therefore merely consists of such a 'spontaneous horizon-point,' and an opera-glass, both attached to a staff of convenient height. Planting this staff on the ground, and merely taking care to hold it so nearly vertical as not to throw the bubble altogether out of the field of view, the observer at once, and without any screw-adjustment, obtains the level line."

We cannot follow further into the mazes of scientific apparatus which the author discusses. The book will be read by many; and if we have directed a few more inquirers to its pages, we shall have accomplished our present view.

There is one notable fact which deserves mention ere we close the pages before us, and that is the handsome acknowledgment which Professor Smyth makes to the mechanical constructors—Mr. Adie, the well-known optician; Messrs. Milne, the brassfounders; and Messrs. Millar, Bruce, and Johnston, the several workmen who have combined in practically carrying out the various designs for the delicate instruments which figured so favourably in the French Exhibition.

CORRESPONDENCE.

ON THE MECHANICAL EQUIVALENCE OF HEAT—THEORY OF THE EXPANSION OF STEAM AND AIR.

The quantity of heat required to convert one pound of water into steam, at different pressures, is very accurately known, but the volume in its saturated state is not known; that is to say, it is very well known that a pound weight of steam, at a pressure of half an atmosphere, and temperature of 212°—which is about 32 degrees higher than what is due to this pressure—measures about 54 cubic feet; and at one atmosphere, as generally understood, it should measure 27 cubic feet. There is no doubt, however, that the volume is less than this, and that saturated steam, like all other vapours that have been tested, does not follow the law of Marriote, but requires to be raised *above* the temperature due to saturation, increasing distances, with increasing pressures, before being converted into a perfect gas. One pound weight of vapour of ether, which, at a temperature of 302°, and pressure of $37\frac{1}{2}$ atmospheres, calculating by Marriote's law, measures about 340 cubic inches, was found by Caignaird D' La Tour to measure only 107 cubic inches, and appeared in a glass tube pure and transparent. From this, it would then appear, that the product of the volume and pressure of one pound weight of ether is a quantity more than three times greater at one atmosphere than at 37½ atmospheres, the temperature being 302°. In a similar manner, other vapours, and all gases which have been liquefied, have been found to increase in a less ratio in pressure than in density. In the following calculations, I will, therefore, assume the product of the pressure and volume of one pound weight of steam, at all the ordinary temperatures and pressures at which it is commonly used, as a constant quantity, equal to 56,000 foot pounds, and would, therefore, at a pressure of 15 lbs., measure 44,800 cubic inches; or $\frac{1}{56}$th part of a pound, at this pressure, will measure 800 cubic inches, and the product of the volume and pressure constantly equal 1,000 foot pounds, and the total force exerted by $\frac{1}{56}$th part of a pound of steam, at any pressure, in expanding from 1 to 2, 3, 4, 5, 6, 7, 8 volumes, would equal 1,000, 1,693, 2,098, 2;386, 2,609, 2,791, 2,945, 3,079 foot pounds. In looking at these figures, it appears that more than three times the work is done with the same steam when expanded to 8 volumes; but the work which is rendered useful depends altogether upon the relation which the back pressure—that is, the atmospheric or condenser's pressure—bears to the pressure in the boiler, or rather in the cylinder, before it is cut off. A non-condensing engine, with steam at 120 lbs.—the back pressure never being less than 15 lbs.—and a condensing engine with steam at 24 lbs. in the boiler, and 3 lbs. in the condenser, would render useful about equal power with the same quantity of heat, if the steam was expended in each to the same extent, as the back pressure in both would be $\frac{1}{8}$th of the boiler pressure, and in expanding in either

$\frac{1}{56}$ lb. of steam from	1 to	2,	4,	8 volumes	
the total force would, as stated, equal	1,000,	1,693,	2,386,	3,079	foot lbs.,
and the total back pressure would equal	125,	250,	500,	1,000	"
Power available, ...	875,	1,443,	1,886,	2,079	"

Multiplying these last numbers by 56, we will have the maximum duty of one pound of steam, that is, leaving friction and all other losses excepting back pressure out of view; and assuming 6 lbs. of water to be evaporated by one pound of coal, in multiplying again by this we have the duty of one pound of coal as follows, the back pressure, as stated, being $\frac{1}{8}$th of the maximum pressure at which the steam is admitted into the cylinder, and expanded—

From	1 to	2,	4,	8,	volumes—
lbs. lifted one foot	49,000,	80,808,	105,616,	116,424	by 1 lb. of steam,
" "	294,000,	484,848,	633,696,	698,544	" of coal,
consumption,	6·7	4·	3·1	2·9	lbs. of coal an hour per horse-power.

This is, however, a much higher duty, especially for the greatest expansions, than is generally realized in practice, excepting when the steam is used nearly in the state of a perfect gas, as it is in the Cornish engine, where the cylinder is maintained at a much higher temperature than is due to the pressure at which the steam is used, and to this fact, more than to that of high pressure and great expansion, may be attributed the economical results obtained from those engines. The greatest amount of work ever realized from one pound of steam will not, I believe, exceed 110 000 pounds lifted one foot, and this weight of water is said to have been actually raised by the Fowey Consols engine, with steam used in the cylinder at a pressure of one atmosphere only, and expanded to four volumes; at the same time, however, the cylinder was maintained at a temperature of nearly 300°, or nearly 90° higher than the temperature due to the pressure at which the steam was admitted. The most extensive, accurate, and faithfully recorded experiments ever made with the Cornish engine are, I presume, those of Mr. Thomas Wickstead. In those experiments the water lifted by a few strokes of the pump was weighed, and the number of strokes of the engine enumerated by a counter. The water with which the boiler was fed was also accurately weighed, as well as the fuel consumed. It was found that one pound of best small Newcastle coal evaporated nearly 8½ lbs. of water at 80°, and Welsh coal nearly 9½ lbs. The best manner, however, of evaporating water in a boiler, and the most efficient method of using the steam, are distinct questions, and it is the latter only which is at present under discussion. One pound of steam, at a given temperature and pressure, is always the same, whatever quantity of fuel may have been consumed in its production, this latter depending upon the quality of the coal as well as upon the arrangement of boiler.* The following is an abstract from Wickstead's experiments:—

Absolute pressure of steam in boiler.	Temperature of steam in boiler and steam jacket.	Absolute pressure of steam in cylinder before cutting off.	Length of stroke before cutting off steam in feet.	Length of stroke after cutting off steam.	Lbs. of water actually raised one foot for each lb. of steam.	Lbs. of water raised one foot for each pound of Newcastle small coal.	Lbs. of small Newcastle coal consumed per hour per horsepower
30·45	252	14·66	6·03	3·97	73,906	628,201	3·15
34·7	260	15·95	4·77	5·23	86,176	732,496	2·70
42·7	272	18·19	3·97	6·03	89,831	763,763	2·59
45·7	277	19·69	3·52	6·48	93,058	790,993	2·53
51·7	284	20·17	3·13	6·87	101,820	865,470	2·27

The back pressure is not given by Mr. Wickstead, but as the temperature of the condenser was 80°, which corresponds to a pressure of steam of ½ lb., and the cylinder from its high temperature would be maintained in a comparative state of dryness, it is likely that this would not much exceed one pound on the square inch.* If, then, we examine this table, it will be seen in the second line that, with the cylinder at a temperature of 260°, and steam admitted during half stroke nearly, at a pressure of 15·95 lbs., or only about 1 lb. above atmospheric pressure, 86,176 lbs. of water was actually lifted one foot for each pound of water evaporated in the boiler; that is, by expanding to little over two volumes; and this corresponds to 2·7 lbs. of small Newcastle coal an hour per horse-power; or 2·4 lbs. of Welsh coal. The combined steam and vapour of ether engine of Du Trembly has not equalled this as far as I have been able to learn yet. To what, then, has this high duty to be attributed, if not to the fact that the steam is used in a dry state and not as an imperfect gas, or a mixture of water and steam, as it is commonly used? It is very generally conceived that the high duty of the Cornish engine is altogether attributable to high pressure and great expansion; and this principle has, since the days of Watt up to the present time, had many advocates, as its advantages in figures are very conspicuous; but in those cases only in which the cylinder has been maintained at a temperature beyond that due to the pressure of the working steam, has anything like the advantages expected been realized. This high temperature was an object in the attaining of which Watt constantly manifested the greatest solicitude, and I think it is not generally known that this eminent man held a patent for superheating the steam; and, amongst other methods of doing this, he speaks of having set the cylinder in an oil bath, with a fire beneath, and states that the advantages which he obtained by these means were not less than that additional power gained by high pressure and expansion.

Unless furnished with a steam-jacket, the cylinder is always found much colder than the steam in the boiler, however well protected from the atmosphere. The metal being alternately brought in contact first with steam from the boiler, which, meeting with a surface colder than itself, must partly condense in heating the metal, and the pressure being removed, this condensed steam is again re-evaporated into the atmosphere or condenser; and while the steam from the boiler is continually striving to raise the temperature of the metal to an equality with itself, the refrigerating influence of this evaporation is no less constant in its tendency to reduce it to an equality with that of the condenser. The heat produced by the friction of the piston in some measure diminishes the loss from this cause, but still it is often very considerable, especially when the steam is used expansively, as it is believed that the steam itself, after the supply is cut off from the boiler and expanded under the pressure of the piston, partially condenses in producing power. I have already said that, when $\frac{1}{56}$th part of a pound of steam expands from one to two volumes, the whole force exerted by this expansion alone will equal 693 foot pounds; when, therefore, one pound expands from a pressure of 30 to 15 lbs., this force will equal 693 × 56 = 38,808 foot pounds, which is equivalent to 38,808 ÷ 772 = 50 units of heat; but one pound of steam at 30 lbs. pressure contains only 11½ units more heat than the same weight of steam at 15 lbs.; unless, therefore, this difference—that is, 50 — 11½ = 38½ units—is supplied from some external source while the steam is expanding, a portion must condense, and less force would be exerted. It has been found by Regnault that the total heat of saturated steam increases by ·305 for each degree of rise in temperature; that is to say, one pound weight at 312° contains 30½ units of heat more than the same weight of steam at 212°, and taking the temperature at a pressure of 15 lbs. at 212°, and that at 30 lbs. at 250°, the difference is $250 - 212 = 38°$, then the difference in the total heat will, as I have stated, be $38 \times \cdot305 = 11\frac{1}{2}$ units. Or, while it requires 967 units of heat to convert one pound of water at 212° into steam of the same temperature, at a pressure of 15 lbs., to convert the same water into steam at a pressure of 30 lbs., and temperature of 250°, would require $967 + 11\frac{1}{2} = 978\frac{1}{2}$ units. It therefore appears that, when expanded to a great extent, great condensation must take place. If, however, this water which is precipitated during expansion could be removed from the cylinder in the form of water into the condenser, the best results might then be realized with the highest pressures and great expansion; but since, in practice, the greatest portion of this water is re-evaporated in the cylinder, it is important that it should be supplied with heat, and maintained in the form of vapour while expanding.

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* If all engines were furnished with a water meter, by which the quantity used in a month or at stated periods could be seen, the best coal and best boiler arrangement would soon be known, and the efficiency of different engines might then also be rendered apparent.

* Since this was written, I have observed in Mr. Wickstead's valuable work, that the imperfection of vacuum or back pressure was found by him to be equal to 0·730 lbs. per square inch, and the force necessary to work the air-pump, 0 017 lbs. per square inch of steam piston. Therefore, the back pressure, *including* the force to work the air-pump, was rather less than ¾ lbs. on the square inch, or little more than one-twentieth of the lowest pressure at which the working steam was admitted into the cylinder. A non-condensing engine, in which the back pressure is never less than one atmosphere, would then require steam at a pressure of nearly 20 atmospheres, to render available the same power with equal quantities of steam expanding to the same extent; but as the comparative size of the cylinders would be as 20 to 1, this objection may be urged against the use of steam at moderate pressures.

Until within the last few years, as has already been observed, it has always been supposed that all the heat which left the boiler of a condensing engine—excepting that lost by leakage and radiation—was transferred to the condenser, and there found simply in a greater state of diffusion, but undiminished in quantity; but, according to the theory now entertained of heat itself being invisible, motion of the particles of the mass of which the heated body is composed, and capable of transmitting a part of this motion to larger masses of matter, and thereby producing power, a portion only is transferred to the condenser, the residue, or that which leaves the boiler without being found in the condenser, being necessary to produce motion and perform the work in which the engine may be employed.

If, for instance, the whole power of an engine was employed in rubbing surfaces together, the heat which disappears, or at least leaves the boiler without being found in the condenser, would be found reproduced from the friction of those surfaces; indeed, if all the heat which left the boiler was found in the condenser, how could we account for that additional heat which the engine had produced? If the heat in the condenser and that produced by friction together exceeded that which left the boiler, then would it appear that heat had been created from nothing. If, however, an engine was employed in raising any mass of matter, and thereby overcoming the attraction of gravitation, such as in the pumping of water, then, for every 772 lbs. raised one foot, one unit of heat would entirely disappear, and could only be reproduced by permitting this water to descend to its former level.

When water descends freely with the force of gravity motion is acquired, and when this motion is retarded and extinguished the temperature of the water is increased from the friction of its particles; or it may be said that the motion of the particles is accelerated. If, however, the water descends quietly in the buckets of a water-wheel, this motion is transmitted to the wheel, which in its turn may again produce heat, motion, or power. When a motion of 30 miles an hour, or at the rate of 44 feet per second, is produced in a railway train weighing 20 tons, 1,755 units of heat will disappear, independent of that additional force or heat necessary to overcome friction and the resistance of the atmosphere; as this motion would require for its production a fall of 20 tons through $30\frac{1}{4}$ feet, and which, as I have said, is equivalent to 1,755 units of heat, and this heat, by friction, would reappear or give motion to the atmosphere, or otherwise raise the train to a higher level before its motion could be extinguished.

Now, with regard to the quantity of heat which may be converted into power compared to that expended, Professors Thomson and W. M. Rankine have shown very clearly that this depends altogether upon differences of temperature, and is the same for all substances, if compressed and expanded at the same pair of temperatures; and as this difference is to the highest absolute temperature—that is to say, in a condensing engine—as the difference of temperature between the boiler and condenser is to the *absolute* temperature of the boiler, so is the maximum quantity of heat that may theoretically be converted into power compared to that expended.

It is frequently said that air is doubled in volume by an addition to its temperature of 480°, but this is only true when the initial temperature is 20°. When air is taken at 60°, an additional 520° is required to double the volume, and at zero (0°) the volume at this temperature is doubled by an addition of 460°; and so inversely, if air or any other perfect gas at a temperature of zero in Fahrenheit's thermometer was deprived of 460°, in following the same law it would have neither volume nor pressure.

At this temperature, therefore—that is, about 460° below the zero of Fahrenheit's thermometer—it is conceived that all bodies would be utterly deprived of heat. Absolute temperature is therefore to be understood as measured from this point, or is equal to the ordinary temperature plus 460°. Then, according to this theory, a condensing engine with the boiler at a temperature of 220°, and a condenser at 120°, the difference would be 100°, and the absolute temperature of the boiler $220 + 460 = 680°$. This engine would convert $\frac{100}{680}$ parts of the whole heat expended into power—that is, assuming the steam to be expanded to that extent that the temperature would be reduced by expansion alone to the temperature of the condenser, and without transmitting or receiving heat from the cylinder, which, however, is impossible in practice.

To convert a pound of water at 120° into steam at 220° requires 1,069 units of heat. Then, with such an engine, $1{,}069 \times \frac{100}{680} = 157$ units of heat should be converted into power for each pound of water evaporated. Or the utmost power that could be realized from each pound of steam working between this pair of temperatures could not exceed $157 \times 772 = 111{,}204$ lbs. raised one foot. On the same principle, a non-condensing engine, which must expel the steam at not less than 212°—unless mixed with air, which has often been tried, and at present revived and patented by Mr. Storms in America, but the principle of which he does not seem to comprehend—with the boiler at 312°, would convert $\frac{100}{772}$ parts of the heat expended into power, as the difference of temperature is 100° as before, and the absolute temperature of the boiler would be $460° \times 312° = 772°$. If, however, this engine was worked with half air and half steam, the air and steam together might then be expanded to and expelled into the atmosphere at a temperature of 180°; now the difference between 180° and 312° is 132°, and, therefore, $\frac{132}{772}$ parts of the heat expended might then be rendered useful. That is, assuming the quantity of air to be such, that, when expanded to 180°, there would be equal volumes of each, so that at the end of the stroke the steam would itself have a pressure of $7\frac{1}{2}$ lbs. and the air $7\frac{1}{2}$ lbs., when the two together would have a pressure equal to the atmosphere. An engine may produce considerable power with water or steam at 212° if mixed with air, without any condenser. When a vessel is filled with dry air at any pressure, but say 15 lbs., and at a temperature of 212°, if a little water is injected, and the same temperature maintained, the pressure will rapidly rise to 30 lbs., it being well known that the quantity of steam that rises into any given space is not affected by the presence of air or any other perfect gas, whatever may be the pressure of that gas, but depends altogether upon the temperature. This vessel would, therefore, now be filled with steam at a pressure of 15 lbs., and with air at 15 lbs., so that both together would have a pressure of 30 lbs., and if now expanded to two volumes, each would have a pressure of $7\frac{1}{2}$ lbs., unless water was still present, when, if the temperature was still maintained at 212°, the steam would continue to fill the vessel at a pressure of 15 lbs., and the air having now only $7\frac{1}{2}$ lbs. pressure, both together would equal $22\frac{1}{2}$ lbs., or $7\frac{1}{2}$ lbs. above atmospheric pressure; or, if first compressed into a half volume, the air would of itself have a pressure of 30 lbs. and the steam 15 lbs. as before, so that the two together would now have a pressure of 45 lbs., the temperature remaining uniformly at 212°. If the cold air above the water in a boiler is not permitted to escape whilst the water is being heated, the pressure in the boiler will rise to about 25 lbs., or say, would raise a weight on the safety-valve of about 10 lbs. on the square inch when the water acquired a temperature of about 180°, as at this temperature the steam will itself have a pressure of $7\frac{1}{2}$ lbs., and the air which had a pressure of 15 lbs. when cold will now be increased about 3 lbs. in pressure, and when the temperature of the boiler is raised to 212° the pressure will have risen—that is, provided the air has not been permitted to escape—to about 34 lbs., or about 19 lbs. above the pressure of the atmosphere, as the steam itself will now fill the boiler at a pressure of 15 lbs., and the air will have a pressure of about 19 lbs. A non-condensing engine may, therefore, with steam and air together, work between the temperatures of, say 212° and 160°, and such an engine would theoretically convert $\frac{52}{672}$ parts of the heat expended into power.

This law, which was discovered by Dalton, I have verified by many experiments, and an ignorance of which, along with other causes which have not here been noticed, led Mr. Frost of America to propagate very extravagant and erroneous views with regard to the expansion of isolated steam, the properties of which, when superheated, it was assumed by him—and at a later period also by Mr. Siemens—that philosophers had neglected directly to examine. But precisely the reverse of this is the case, as it has been the density and expansive rate of surcharged steam only—that is, steam isolated from water, and heated beyond the temperature due to the pressure—that physicists have yet been able to determine; and much more accurate methods had been taken for arriving at this than those adopted by either of the gentlemen I have named. The difficulties in arriving at the density of saturated steam, of which we are still ignorant, are, I believe, greater than is generally conceived. Regnault has, however, been some years engaged in this and like researches, and we are likely soon to have the results of his experiments.

You have frequently noticed and described in your *Journal* a machine which I had the pleasure of witnessing in the United States, invented by Dr. Gorrie, for the production of ice by the compression and expansion of air in separate cylinders. In working this machine, the expenditure of power for the abstraction of a given quantity of heat from the cold cylinder and its production in the warmer cylinder, would, of course, depend altogether upon the difference of temperature; as, if both cylinders had the same temperature, the power required would only equal that necessary to overcome the friction of the machine, and the heat absorbed by the air in expanding in the one cylinder would be the same in quantity as that evolved in the other, so that by this means any quantity of heat might theoretically be conveyed from one substance to another of equal temperature without any expenditure of power. But, if we assume the cold cylinder to have a temperature of 20°, and the warm or compressing cylinder to be prevented from rising above 70°, then an engine working between those temperatures would convert ($70 - 20 = 50$, and $70 + 460 = 530$) $\frac{50}{530}$ parts of the heat expended into power. And, conversely, by the expenditure of a force equivalent to that which would be required to produce by friction alone 50 units of heat, 530 units of heat would be produced in the warm cylinder, and $530 - 50 = 480$ units of heat would be abstracted from the cold cylinder; or, while the heat evolved by compression at 70° in the warm cylinder would be more than ten times that which was equivalent to the power expended, the heat absorbed by the air in expanding at 20° would be more than nine times that which was equivalent to the mechanical force expended in its abstraction.

Dr. Gorrie evolved large quantities of heat with this machine with a small expenditure of power, but the quantity of ice produced was much diminished by the heat arising from the friction of the machine. It is obvious, however, that, with a good steam-engine, it is theoretically possible to produce a greater quantity of ice than the steam from which the power is derived would be capable of melting, and at the same time, as both must go together, a greater quantity of heat than this steam itself contains; but quantity of heat without difference of temperature cannot produce power any more than quantity of water without descent.

Feeling that I have already trespassed much too far upon the limits of your valuable space, I will at present refrain from further intrusion; but as I think that this theory of heat gives a rational explanation of many phenomena which have hitherto appeared to be incomprehensible, I may return to the subject on a future occasion.

Before concluding, I will only add, with regard to the highest temperature that may be generated in a furnace (the highest observed, as Mr. Edward states, being 3,479°), that, in taking the specific heat of air at 240°, and the heat evolved by the combustion of one pound of carbon at 14,000 units—this is readily estimated, as the same quantity of heat which would raise the temperature of 14,000 lbs. of water one degree would raise $14{,}000 \div {\cdot}240 = 58{,}333$ lbs. of air one degree, or 11·6 lbs. of air, which is the quantity required for the combustion of 1 lb. of carbon, would, by the same heat, be raised $58{,}333 \div 11{\cdot}6 = 5{,}028°$. The highest temperature should then equal 5,028° plus the temperature at which the air is admitted, and minus the quantity of heat required to heat the carbon itself. I believe, however, that it has been found that a pound of carbon evolves 14,400 units of heat, and that a temperature over 4,500° has been attained. Notwithstanding these observations, I wait anxiously for the promised report of your correspondent, and heartily wish him success.

Glasgow, December, 1855. J. B.

ENDLESS-BELT SHAPING SAW.

In the last issue of the *Practical Mechanic's Journal*, you gave a plate and interesting description of a cross-cutting saw of peculiar value for the timber converter. It has served to remind me of a peculiar shaping saw which I examined in the French Exhibition, and which was, I think, the most efficient tool I ever saw. The cutting blade consisted of a very narrow endless band or web of saw plate, toothed on one edge, and running over a pulley of considerable diameter, set pretty high up, and beneath a second pulley fixed underneath the saw bench, and driven at a high speed. I stood for some time watching a workman at this saw, and was greatly astonished by his performances. He had a good supply of pieces of mahogany, walnut, and other cabinet-maker's woods lying beside him, all ready marked out to the various forms required by the furniture-maker, such as table feet, scrolls, and differentially curved ornamental forms. These rough pieces were taken up one by one, and cut to the several forms set out upon them, with a rapidity which certainly surprised me a good deal, especially when I mentally compared the operation with the slow process which I had often witnessed as practised at home by our joiners with a common frame saw.

The idea was very novel to me, and it appeared to do its work wonderfully well; and I draw your attention to it, as I don't remember ever seeing any published description of such a contrivance.

O. P. B.

Bellfield Print-Works, Rochdale, January, 1856.

[If our correspondent will turn to our article IV. on the French Exhibition, he will find at page 194, for December last, that we have made reference to this very machine as "Périn's ribbon sawing frame;" calling attention at the same time to the fact, that Mr. M'Dowall had previously carried out the plan in this country.—*Ed. P. M. Journal.*]

IMPROVED PROPORTIONAL COMPASSES.

When the points of ordinary proportional compasses are broken or bent, the instrument is rendered perfectly useless, as its accuracy depends upon the length and position of the points. To remedy this evil, I have conceived the idea of rendering the points adjustable in such a manner that they may be accurately reset by means of a guage when broken or injured. The improved instrument is represented in edge view in fig. 1, whilst the guage for the length is represented in fig. 2. The ends of the compass legs are made with small sockets, A, into which needles are fitted in angular positions, these needles being held in their sockets when adjusted, by small pinching screws. The guage, fig. 2, is a straight piece of metal with its two ends bent at right angles, and with a mark at B, which corresponds with the index mark on the sliding piece, C, of the compasses, when this is set for giving an equal opening at both ends of the instrument. When the needle points are broken or inaccurately placed, the compasses must be applied to the guage, the slider being first set to correspond with the mark B, and the needles can then be shifted out or in, so as to bring their points to the proper positions coincident with the ends of the guage. The inclination given to the needle sockets is such, that the points of each pair of needles only touch when the needles are accurately adjusted; and if the sockets are carefully made and their inclination accurately determined, and the needles perfectly straight, no guage will be required, as all that will be necessary when the points are injured, will be to take new needles and to set them in the sockets, so that the individual points of each pair will just touch each other. The guage, however, insures extreme accuracy.

Joseph Roberts.

Hyde, Manchester, January, 1856.

Fig. 1.

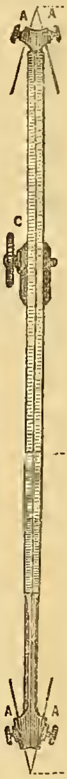
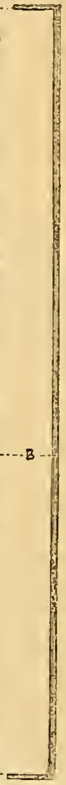
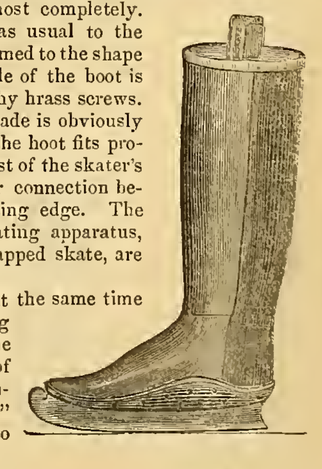


Fig. 2.



SKATING BOOT.

The sketch which I take the liberty of sending you represents a combined boot and skate, which I invented during the last frost for my own convenience, and found to answer most completely. The steel skate blade is attached as usual to the wooden sole stock, this stock being formed to the shape of the foot to fit the last, and the sole of the boot is worked over it, and fastened thereto by brass screws. Under this arrangement the skate blade is obviously firmly fastened to the foot, provided the boot fits properly; and thus I get rid of the greatest of the skater's difficulties, that of obtaining a proper connection between the foot and the actual skating edge. The lightness and easy wear of such skating apparatus, in comparison with the common strapped skate, are very appreciable, I can assure you.



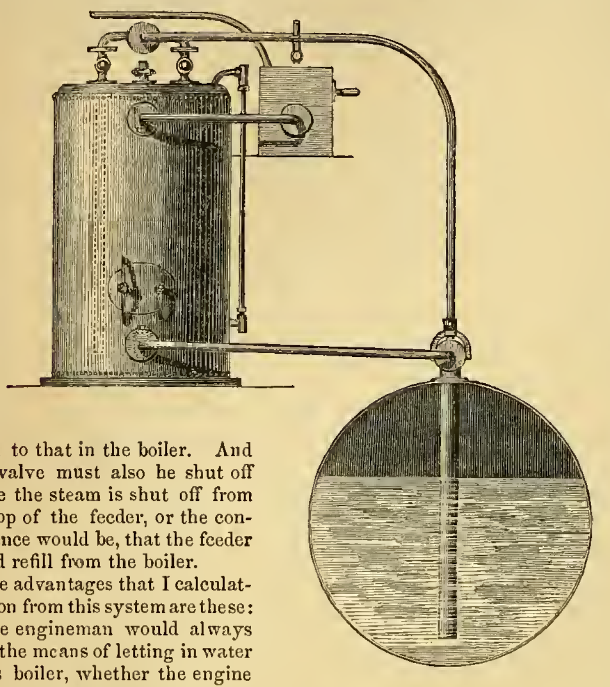
To cheapen the contrivance, and at the same time do away with the inconvenience arising from the boot not fitting properly, the blades may be fitted to the soles of "lace-up" boots, and, for greater firmness still, the "cricket shoe strap" over the toe portion may be added to the boot.

G. Tidcombe, Jun.

Watford, January, 1856.

FEEDING STEAM BOILERS.

I now present a sketch of the feeding apparatus which I have recommended for the prevention of boiler explosions, and as its action has already been well explained, I need not describe it further than to say, that the valve for admitting the water from the feeder to the boiler, must not be opened until the temperature and pressure in the feeder is equal to that in the boiler. And this valve must also be shut off before the steam is shut off from the top of the feeder, or the consequence would be, that the feeder would refill from the boiler.



The advantages that I calculated upon from this system are these:—The engineman would always have the means of letting in water to his boiler, whether the engine is working or not. The evaporation from the heat of the flues during meal-times and other stoppages of the engine being very considerable, this may be compensated for by opening the regulating valve to any degree required, and feeding may be carried on during the night. There is a line in all boilers at which it is desirable to keep the water, and by regulating the valve this can be easily maintained under all circumstances.

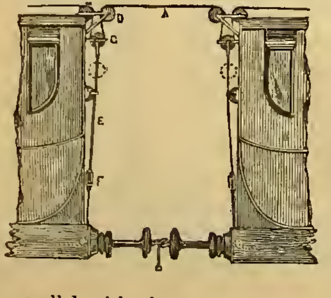
My sketch represents one of two feeders on the same line, supplied with steam from the same pipe, and fed at the same pipe on the boiler; and the water is supposed to be admitted through the same funnel.

Cour de Prince, à Gand Belgique. J. D. Philips.

COMMUNICATION BETWEEN RAILWAY GUARDS AND DRIVERS.

I propose to effect the ready communication between different parts of a railway train, by means of a cord stretched along the tops of the carriages, in such way as to provide for the elongation or contraction of the train. This provision being duly made, there is nothing to prevent the forming of a perfect system of communication between all the parts of a train, at all times.

In my sketch I have represented the contiguous ends of two carriages in a train. At A is a cord passing along the centre of the carriage roofs over fixed pulleys, B, set one on each end of the roofs. In each case, after passing from the pulley, B, the cord descends and passes beneath the traversing pulley, C, and then up and over a second fixed pulley, D, also upon the carriage roof; this routine is continued throughout the entire train. To the stud of the traversing pulley, C, is attached a cord, E, descending over a guide pulley carried by the carriage end, so as to keep the movement of the pulley, C, parallel with the carriage end, and thence passing to the pulley, F, where it ends. Round this latter pulley another cord is passed; both ends of this cord being continued downwards and passed beneath a pair of pulleys, represented by dotted lines at the level of the framing. One end of the cord so conveyed, is fastened to the draw-rod inside the framing, whilst the other end is attached to the middle of a bar slotted at each end, a stud on each buffer-rod entering each of the slots. This bar is intended for equalising the movement of the buffer-rods in turning curves. When the train is started, it is of course elongated by reason of the pull upon the draw-springs, and the draw-rods then set free just so much of the lower cord as equals the amount of the extension. At the same time, the portion of the cord, A, between the contiguous carriage ends is lengthened, and takes up the exact length of cord set free by the draw-rods, through the action of the intervening rope, E. Hence, with this arrangement, the cord, A, is kept at one uniform tension, whether an extra pull of the engine elongates the train, or the setting on of the brakes compresses it.



The signal cord, A, may be acted upon in working, either by a winch, or by the hand, direct, to ring a bell on the tender; or, if continued forward and passed over a pulley at any convenient part of the fire-box, it may be used to sound a whistle. To do this, a weight should be hung to the end of it to keep it tight, the weight to hang perhaps two feet below the handle of the whistle, so as to allow the cord to be shortened about that length by any sudden jerk, without sounding the whistle. The cord being passed through a hole in the whistle handle, the elevation of the weight obviously sounds the whistle.

January, 1856. Kenneth.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Glasgow, September, 1855.

Section C.—Geology.

"Report on the present state of our knowledge of the supply of water to towns, by J. F. Bateman of Manchester."

Mr. Bateman remarks, that till a very recent period the question of water supplies on a large scale has in this country been much neglected. The works, however, now designed and carried out are amongst the largest, the boldest, and most successful productions of the age, rivalling the greatest undertakings of the ancients and the Romans. Towns are now almost universally supplied with an unlimited quantity of water in the most perfect and convenient manner, the water being conducted into the interior of the houses, and thus applied to every domestic want. Towns were formerly supplied by artificial means, by the collection of springs, which were conducted to public fountains, from which the inhabitants fetched water as they required it. The supply to Rome on this system is said to have amounted at one time to 50,000,000 cubic feet per day to 1,000,000 inhabitants, which is upwards of 300 gallons a day to each person. After glancing at the early attempts in this country to procure water by artificial means, he shortly described the manner in which Peter Morice, a Dutchman, first raised water from the Thames for the supply of London in 1581, by means of water-wheels worked in the arches of Old London Bridge, and the construction of the New River Works, by which water was brought to London from Hertfordshire by Sir Hugh Middleton—a distance of forty miles—in the beginning of the seventeenth century. He stated that London is now supplied with water by nine companies, who deliver about 44,000,000 gallons per day, and derive an annual revenue of about £236,000. He then went on to say, that the different sources from whence a town can derive a supply of water, beyond that which the inhabitants can collect in cisterns from rain, or procure by wells on their own premises, may be classed as follows:—1st, from springs; 2ndly, from artesian wells, or from water to be obtained from absorbent geological strata; 3rdly, from rivers; 4thly, from gathering grounds, where the surplus water of wet seasons is collected into large storage reservoirs; and 5thly, from natural lakes. 1*st*, *Spring water* varies materially in its quality, according to the geological character of the rocks through which it passes or through which it issues. It is generally excellent as a beverage, but frequently, from its excessive hardness, unfitted for domestic use. Thus most of the primitive rocks, and many of the secondary ones, yield soft water of excellent quality, while limestone, chalk, the old and new red sandstone, the lias and oolite, all yield waters of a hard description. Rain water freshly caught in towns is generally from 1° to 2° of hardness. The springs from granite, mica slate, millstone grit, and the greensands, as they are developed in Surrey, vary, with some exceptions, from 1° to 3° of hardness; the springs from the new red sandstone, from 5° to 20°; limestone and chalk, from 10° to 20°; and those from the lias and the oolite run up to 30° and upwards. The *quantity*, too, of spring water from any given area varies according to the geological character of the country. Absorbent measures, such as sand, gravel, chalk, and limestone, yield springs in greatest abundance; next, the more loosely stratified rocks, such as the coal measures and the millstone grit; last of all, the slates, the Silurian rocks, and the primitive formations. Supplies of towns by spring water, and various instances of large springs, were adduced. The most abundant supply of spring water, from an extended area, was stated to be in the greensand formation near Guildford, in Surrey, where between 30,000,000 and 40,000,000 gallons of water per day, not exceeding 2½° of hardness, might be produced for the supply of

London. Various particulars as to the yield of other geological measures were given, from extended observations in many parts of the country.—2*ndly*, *From Artesian Wells*. This is a system of obtaining water largely resorted to in the neighbourhood of London, in the north of France, and in other places where the geological conditions of the country are favourable to its adoption. It is adopted where absorbent measures containing water derived from distant elevated points are covered by other measures of an impervious or retentive character. A bore-hole is sunk through the impervious upper stratum to the water-bearing stratum below. As soon as the water is reached, it rises through the bore-hole to the surface, the quantity of water yielded depending upon the pressure and the rise of the bore-hole. The Artesian well at Grenoble, in France, yields 880,000 gallons per day; fifteen wells at Tours, in France, yield about 4,000,000 gallons daily; and it is estimated that the quantity obtained in this way in London and its immediate neighbourhood is equal to 8,000,000 or 10,000,000 gallons per day. The supply derived from wells in the new red sandstone was then adverted to, the particulars of supplies yielded at Liverpool, Wolverhampton, and other places being given. At Liverpool, according to the report of Mr. Robert Stephenson in 1850, seven wells yielded about 3,900,000 gallons per day. The quantity of rain which penetrates the ground, and the probable yield in different districts, according to the annual rain-fall, or the permeable character of the rock, were investigated, and it was shown that, except where the rain-fall is large, no great supply of water could reasonably be expected from wells in the new red sandstone. The hardness of the water varied generally from 5° to 20°.—3*dly*, *From Rivers*. Rivers have been naturally and largely resorted to for the supply of towns, and still contribute to the wants of many important places; but as agricultural improvements, population, and manufactures extend, they are gradually becoming unsuited to the purpose, and are being abandoned for purer sources.—4*thly*, *From Gathering Grounds*. From these sources the most important supplies of modern times have been procured. Many points of considerable interest enter into this branch of the subject—the annual fall of rain—the loss by evaporation and absorption—the quantity of water flowing off the ground or issuing in springs—the duration of droughts—the heaviest falls of rain, and the capacity of reservoirs. Mr. Bateman entered largely into these questions, showing that the rain varied from 20 inches to nearly 200 inches per annum, according to locality; that from 12 to 16 inches of that which fell was lost by evaporation, vegetation, &c.; and that the storage capacity of reservoirs should vary from 20,000 to 60,000 cubic feet and upwards, according to the annual rain-fall for every acre of collecting ground. He gave the particulars of the Manchester, the Liverpool, and other waterworks in this country—the Croton aqueduct for the supply of New York, in America—the Boston waterworks, &c., together with some information upon filtration, and the methods adopted for separating pure water from that occasionally discoloured.—5*thly*, *The Supply from Natural Lakes*. This mode of supply, where it can be adopted, has many recommendations from its extreme simplicity. The towns of Whitehaven, Dumfries, and Inverness are supplied in this way, and Glasgow is to be supplied from Loch Katrine. Objections have been taken to the extreme purity of the water in many cases of lake supply from its action on lead; but the late investigation in the supply of the Loch Katrine water to Glasgow, has pretty clearly demonstrated the safety with which such water can be supplied for domestic purposes, even through leaden pipes.

INSTITUTION OF CIVIL ENGINEERS.

SESSION 1854-55.

The Council have this year awarded the following premiums:—

1. A Telford medal, to James Barton, M. Inst. C. E., for his paper "On the economic distribution of Material in the sides or vertical portion of Wrought-Iron Beams."

2. A Telford medal, to Edward Ellis Allen, Assoc. Inst. C. E., for his paper "On Steam and Sailing Colliers, and the various modes of Ballasting."

3. A Telford medal, to Richard Alexander Robinson, Assoc. Inst. C. E., for his paper "On the application of the Screw Propeller to the larger class of Sailing Vessels."

4. A Telford medal, to Joseph Phillips, for his "Description of the Iron Roof, in one span, over the Joint Railway Station, Birmingham."

5. A council premium of books, suitably bound and inscribed, to James Leslie, M. Inst. C. E., for his paper "On the flow of Water through Pipes and Orifices."

6. A council premium of books, suitably bound and inscribed, to Peter William Barlow, M. Inst. C. E., for his paper "On some peculiar features of the Water-bearing Strata of the London Basin."

7. A council premium of books, suitably bound and inscribed, to James Brunlees, M. Inst. C. E., for his "Description of the Sea Embankments across the Estuaries Kent and Leven in Morecambe Bay, for the Ulverstone and Lancaster Railway."

8. A council premium of books, suitably bound and inscribed, to Frederick Braithwaite, M. Inst. C. E., for his paper "On the Infiltration of Salt Water to the Springs of Wells under London and Liverpool."

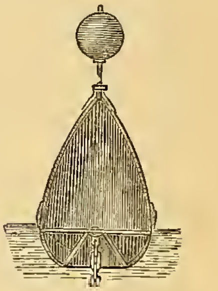
9. A council premium of books, suitably bound and inscribed, to George James Munday, Assoc. Inst. C. E., for his "Description of the Coffer-dams used in laying the lines of Water-Pipes from Richmond to Twickenham, across the Thames."

10. A council premium of books, suitably bound and inscribed, to Lavington Evans Fletcher, Assoc. Inst. C. E., for his "Description of the Landore Viaduct on the South Wales Railway."

A list of 56 subjects, slightly modified from last year's list (see p. 163, vol. 7), has also been published in illustration of the themes on which communications for premiums are invited.

NOVEMBER 13, 1855.

"On the Construction of Buoys, Beacons, and other Stationary Floating Bodies," by Mr. G. Herbert.—Floating sea-marks, as ordinarily constructed, were, it was stated, admitted to possess the defect of riding uneasily on the waves, under which they were frequently buried, so as to be scarcely visible when most required; besides which, it was not an uncommon circumstance, in heavy weather, to find that a buoy had broken its chain and floated away. The present form of the buoys, and the fact of the mooring chains being attached to a point far below the centre of gravity, sufficiently accounted for these and other acknowledged defects, and induced the proposition of a form of stationary floating body, which should have a tendency to ride easily and to retain its perpendicularity, whilst the point of attachment of the mooring chain would be in such a situation as to subject it to the least amount of strain, and not be liable to draw the buoy down into the trough of the waves. With this view, a wrought-iron, pear-shaped buoy was constructed, of a circular form in plan, and terminating above in an apex, so distributing the weight, as that the centre of gravity should be situated a little below the centre of the plane of flotation, and the bottom was made concave and raised up internally, so as to form a cone, to the internal apex of which the mooring chain was attached.



This form was found so completely to answer the purpose, that several buoys were made by Messrs. Brown, Lennox, & Co., for the Corporation of the Trinity House, and were pronounced to be superior to any previously built. A buoy of 9 feet in height, 6 feet 6 inches diameter, and having only 2 feet of the body submerged, exhibited, under all circumstances of wind and tide, an upright body of 7 feet out of the water. This quality of retaining its vertical position arose from the force of the tide or wave being simultaneously exerted upon one side of the exterior of the buoy, and on the opposite side of the interior cone; the forces so nearly balancing each other as to retain the floating body in an almost perpendicular position.

Encouraged by the success of the first experiments, the Trinity House authorised the construction of a wrought-iron sea beacon on the same principle. The floating base was 20 feet in diameter, divided by radiating bulk-heads into six water-tight compartments; it drew 4 feet 6 inches water, and supported a tower, also of wrought-iron, 28 feet high, 7 feet diameter at the base, and 3 feet 6 inches diameter at the top, surmounted by an iron ball of the same diameter. This beacon was moored in the overfall of the sea, at the South Sand Head of the Goodwin Sands, and was admitted to have been the best and most conspicuous sea-mark ever laid down. During very heavy storms it was observed that the greatest angle assumed by the tower did not exceed 10° from the perpendicular, without any tendency towards circular motion. When it had been afloat for about five weeks, it was observed to sink gradually during very moderate weather, evidently from having sprung a leak. It was conjectured that this casualty arose from the mooring chain having been improperly fixed in the hawse-pipe of the cone, instead of being below it, and thus that the links were brought into contact with the plates of the compartments, which being only $\frac{3}{8}$ths inch in thickness, were soon chafed through, probably in several places simultaneously, and the several compartments becoming filled with water the beacon was submerged. The recurrence of such casualties in similar structures could, in future, be easily remedied by attaching the mooring to the proper point in the cone, as is done in the buoys, and thus guard against the possibility of any friction against the body of the water-tight compartments.

It was now proposed to carry out this principle of construction upon a larger scale, and to erect upon the floating base a tower sufficiently large to serve as a substitute for a lighthouse. A plan for such a structure, as submitted to the Trinity House by Sir Charles Fox, was described. The floating base was 80 feet in diameter, and drew 20 feet water; the tower was 130 feet high, 24 feet in diameter at the base, and 14 feet at the lantern; the weight of the tower and lantern was 117 tons; and the total displacement of the whole building was 1602 tons; the centre of gravity being 2 feet 6 inches below the surface of the water. The weight of a double mooring chain, the links of which were $3\frac{1}{4}$ inches diameter, would be about 46 tons in about 30 fathoms of water, when under the greatest pressure of wind and tide, and the catenary curve would then be about 47° from the perpendicular; the extreme pressure to which the chain would be subjected afloat, would not exceed 92 tons. The security of this sea light-tower would depend upon its moorings, which, for greater certainty of holding, should probably be Mitchell's screw moorings within certain limits of depth, and if the chain weighing 46 tons was not considered sufficiently strong, any additional strength might be added, and would only have the effect of immersing the floating base a few inches more. In the event of any unforeseen occurrence causing the sea light-tower to break adrift, it could immediately and with certainty be brought up by a spare chain and anchor.

The extreme pressure of the wind upon this structure would not exceed 34 tons, and that would only cause the tower to incline about 1° 28′ from the perpendicular. The pressure caused by the speed of the tide at 4 miles an hour, could be taken at 30 tons upon the immersed portion.

Some interesting observations made by Mr. Douglass in 1853, at the request of the author, on the number, height, and speed of waves, at the lighthouse in course of construction at Bishop Rock, the most westerly of the Scilly group, tended to confirm the opinion, that little or no inconvenience would result from the action of the waves even in that exposed locality. The statement showed, generally, that waves which, when measured from the hollow to the unbroken crest, had a height of

8 feet, were in number 35 in one mile, and 8 per minute.
15 feet, do. 5 & 6 do. 5 per minute.
20 feet, do. 3 do. 4 per minute.

The new form of sea light-tower was proposed to mark the sites of shoals, or rocks, or islands, which were difficult of access. Lighthouses for this purpose being generally required as warning, rather than as guiding lights, it usually was of little importance whether the light was exactly upon the point of rock from which it was intended to warn a vessel, or whether it was a short distance from it, so that the existence of the danger was made manifest.

It was submitted, that this form of construction might be advantageously employed for "guiding" or "fair-way" lights. The problem of exhibiting lights of any considerable altitude in very deep water had not hitherto been solved, and consequently the majority of the lights now in existence were not those leading into a right channel, but those which warned from a wrong one, and so long as that plan was followed, the system of lighting would be one-sided and defective. Practical men, however, now appeared to think that the old system should not be continued, and as the sea light-tower was capable of being moored in any depth of water, however great, it might be placed midway in any channels as an invitation to the right course, and thus insure to all vessels a safer and a speedier navigation.

The lighthouse on the Skerryvore Rock occupied seven years in building, and cost upwards of £90,000; whereas, by means of the sea-light tower, the same object might be accomplished in one year at a cost of £30,000. The site of the Bell Rock could be equally efficiently marked at a cost of about £20,000, instead of £60,000; and that of the Eddystone at about £15,000, instead of £40,000; and the new form of light-towers would possess the advantage of being accessible in all weathers.

The observations were limited to sea-marks, but if the principle of construction proved to be correct, it would evidently be applicable to floating forts, and to almost every other description of stationary floating body, several designs for which were exhibited.

November 20.

Discussion on Mr. Herbert's paper.

Attention was directed to a new kind of Reflector for Lights; it was composed of silvered porcelain, and appeared to possess a very brilliant polish, which was stated to be indestructible. Hitherto reflectors of small sizes only had been produced, but by means now adopted it was expected that they could be made as large as 21 inches in diameter over the mouth. If this manufacture was brought to the perfection that was anticipated, a great economy would result, as the silvered copper reflectors at present used were very expensive originally, were liable to oxidation, and were frequently injured by the care of the attendants, in rubbing them to keep the reflecting surfaces bright. The new Porcelain Reflector has been transmitted by the Hon. Major Fitzmaurice to Captain Washington, R.N., by whom it was introduced to the notice of the meeting.

After the meeting, Mr. Lavanchy exhibited in the library a model of an Expanding Portable Bridge of his invention. The system had been tried at Paris, where a bridge on this principle, fixed upon a boat in the canal, had been used for permitting the passage of troops; the boat yielded considerably to the weight of the men brought upon it, but the bridge remained stiff, and the commanding officer had reported well of its properties.

The principle was that of a number of strips of iron or wood, pinned together transversely at such points as that they should form a series of equilateral parallelograms, the extension being obtained by the motion upon the connecting pins, somewhat on the principle of what was commonly called "lazy-tongs." A bridge of this construction could be made very light for any moderate span, and be conveyed upon a boat to be projected to both banks of a stream; be used for the centre, or any portion of a long floating bridge of boats; be carried upon a pair of wheels with a regiment, or used for numerous civil purposes; and its construction was stated not to be at all expensive.

November 27.

"On the application of Volute Springs to the Safety Valves of Locomotive and other Boilers," by Mr. J. Baillie.—The volute spring, invented by Mr. Baillie, the locomotive superintendent of the Central Hungarian Railway, was described to consist of a single plate of steel, wound spirally in a conical shape, sustaining pressure and deflection in reference to its breadth instead of thickness, and was constructed of thicker and deeper plates, according to the increased strength desired.

The effect attained by this form of applying steel to resist pressure was found to be such, that equal loads were sustained by one-third the weight necessary for elliptical springs of like capabilities and power.

From the peculiar mode in which the rigidity and elasticity of the material was applied in these springs, although so very light, they were not liable to break, or to be injured by any amount of force, if properly fitted; and the experience of upwards of seven years had proved that they were very economical for all railway purposes. The same experience had proved the unfitness of caoutchouc or other substitutes for steel for mechanical application, where great wear and tear had to be sustained, whilst the elliptical form of spring had many disadvantages, which were obviated by the direct action, the compactness, and the elasticity of the volute; and the saving effected by their adoption was not only in the first cost, which was great, but also in repairs, owing to the simple construction and application of the volute; whilst, in addition, much of the ironwork necessary in fitting ordinary springs was saved.

Concurring in the almost universal opinion, of the inadequate dimensions of the safety-valves being the most fruitful cause of explosions, and, at the same time, appreciating the practical difficulties attendant upon increasing the number or the area of the ordinary valves, with the present system of weighting them, Mr. Baillie determined to try whether a safety-valve of large area could not be conveniently and steadily held down by a number of volute springs of known power. This appeared to act extremely well; and in order to test the new system, in comparison with the ordinary method, a safety-valve of 12 inches diameter, held down by seven volute springs, was adapted to a locomotive boiler, on which there was also an ordinary valve of 3·6 inches diameter, weighted with the usual lever and spring balance. The boiler possessed an area of heating surface of 890 square feet; but lest the cylinders should take too much steam, the engine remained stationary during the experiments, and the fire was urged by a constant jet of steam, of ½ inch diameter, into the chimney. The two valves were equally weighted to a pressure of 64 lbs. per square inch. The large valve was then fastened down, and in four minutes the pressure of the steam had increased to 105 lbs. when the small valve had risen to 1-12th of an inch; and the experiment was stopped, as the valve could not discharge the steam so fast as it was generated.

The small valve was then screwed down, and the large valve was set free; in four minutes the pressure had only increased from 64 lbs. to 76 lbs. per square inch, or 12 lbs., when the valve rose 1-24th of an inch; and although the fire was powerfully urged for upwards of half an hour, the pressure of the steam could not be raised beyond 76 lbs., as the large area of the safety-valve allowed all the steam that was generated to escape freely.

These experiments were considered so satisfactory, that the system of using volute springs for the valves had been generally adopted for the boilers of the locomotives of the Hungarian and Austrian Railways, upon which Mr. Baillie was engaged.

SOCIETY OF ARTS.

November 21.

This was the first ordinary meeting of the 102nd Session. The Rev. J. Booth, F.R.S., Chairman of Council, presided, and read an inaugural address in conformity with the usual custom. In the course of his remarks, he stated that Mr. Chadwick having drawn the attention of the Emperor of the French to the advantages to be secured in Paris by the adoption of a thorough system of drainage, one of the worst drained districts in that city had been placed under Mr. Chadwick's control.

November 28.

"On the Present Position of the Iron Industry of Great Britain, with reference to that of other countries," by Mr. J. K. Blackwell.

"On the Gums and Resins of Commerce," by Mr. P. L. Simmonds.—The author drew attention to the fact, that whilst our information and our practical use of gums and resins had so largely increased in late years, yet our printed information on the subject had made no progress. He instanced the new edition of the Encyclopædia Britannica, the articles in which work bearing on the matter were little better than reprints of knowledge four years old.

Gum-arabic is the produce of the several varieties of Acacia. A few years ago, a considerable trade was carried on by the Cape colonists with Kaffirland, in the gum gathered from the mimosa tree; but our "gum substitute," or dextrine, made in this country from diseased potatoes and damaged flour, has entirely superseded the foreign product. The artificial material is unfitted for the purposes of food; but its adhesive powers are superior to those of gum-arabic, whilst it can be made at one-fourth of the cost of that substance. From 50 to 100 tons a week are now used by our manufacturers. Our annual gum and resin consumption amounts to £2,000,000 worth. The imports of gutta percha have come up to 3,500 tons, and one million trees have been destroyed to procure this supply.

December 5.

"On the Construction of Private Carriages in England, and on the Carriage Department of the Paris Exhibition of 1855," by Mr. J. H. Hooper.—This paper was by a member of the firm, to whose application of photography in carriage building we recently drew attention. The author commenced by stating, that one of the first requisites for a good carriage was thoroughly-seasoned timber. Our English hedge-row ash is excellent for the parts requiring strength and solidity. English oak of small growth furnishes good wheel spokes, elm being generally used for the stocks or centres of wheels. America supplies beech and pine. Honduras mahogany has, up to the present time, been found the most suitable wood for carriage panels; but it must not have a figured or prettily-marked grain, as the sun's action would cause a blemish, by showing up the grain of the wood under the varnish. To counteract the effects of hot weather, and also of wet and damp, the upper parts of the best carriages are covered with a hide of thick leather, put on in a wet state. This, being strained and fastened, shrinks in drying, and forms a durable outer covering. This leather, when dry, is painted and varnished about twenty-five times. This material is also used in large quantities in other parts of a carriage. Of late years, a process called "japanning" has been introduced. After the hides have been prepared of a suitable thickness, the grain of the leather is concealed by repeated coats of japan. The hide is carefully dried, after each application, in a moderately heated stove, free from dust. Enamelled leather undergoes a process called "graining." This is done by folding the hide together, and lightly rubbing the japanned sides, one against the other, with a piece of wood having a toothed surface, and held in the right hand. Of other articles used in this manufacture it was mentioned, that the only sort of varnish yet found suitable was that from gum copal. Olive oil is used for lubricating the axles, and linseed and boiled oil for painter's work. An American mineral paint is used for filling up the grain of the wood previous to applying the finer paints, which latter range from the moderate-priced greens and browns to the luxuriously expensive lakes, cobalts, and carmines. In silks, the kind called "reps" in France and "brocatelles" in England has now superseded all other sorts. In carriage laces, the Germans have, for some months past, been introducing a considerable quantity at very reduced prices compared with English-made laces. This has caused some manufacturers at Coventry to establish improved looms for this department of weaving, by which they now produce goods of equal quality at a somewhat lower price. In reference to the position of carriage wheels, the author gave it as his opinion that the centre of a wheel should never be so high as a horse's shoulder, at the point where the trace is usually attached to the collar. If it is higher, there is a tendency to drag the wheel into the surface of the road, whilst, if it is lower, the wheel would be lifted off the ground, and the horse would then have to carry part of the weight of the carriage. Many wheels have, for some years past, been made by machinery; but it is a disputed point whether those made by machinery or hand labour are the best. English axles still claim a decided superiority over foreign ones. The steel springs are made from the best Swedish or Russian iron. Of late years, india-rubber has been tried in connection with steel springs, or as a substitute for them. A suspending plan, adapted to a carriage by the firm to which Mr. Hooper belongs, has now been in constant and successful use for three years. The same principle has been more recently applied to some hospital carriages for the army in the Crimea. In campaigning there, india-rubber springs would be found of great utility, as the carts and waggons of the country would, in a few minutes, be readily converted into easy conveyances for the sick and wounded. The author concluded this section of his paper by remarking, that they were in want of several improved materials and appliances. Among the former are—colourless oils for painter's use; a colourless varnish, all the copal varnishes now in use having a brown tinge, which is injurious to delicate colours; a durable ultramarine blue; cheaper and more durable lakes. Among the latter is a machine for sewing leather for carriages and harness. Though various attempts have been made, they have up to the present time been unsuccessful, as they will not work with a strong waxed thread, or draw the stitches sufficiently tight. Passing next to the consideration of the carriage department of the Paris Exhibition, Mr. Hooper examined in detail the contributions of each country exhibiting. He expressed surprise that in none of the industrial displays has there been a single specimen of a posting travelling carriage, and in each there has been almost an entire absence of public carriages for common roads. This is the more to be regretted, as there are many parts of the Continent still without railroads; and it is notorious, that for every two passengers conveyed by an English stage or mail coach, taking weight for weight, a French "diligence" or German "eilwagen" only carries one passenger, and at little more than half the speed, though many of the roads are now as good as in England. Generally, it may be remarked that England excels foreign countries in the convenience and variety of the kinds of carriages made, in the simplicity and soundness of their construction, and in the superiority of their axles, springs, floor-cloths, leather, and cloths. Very few materials, with the exception of ultramarine and vermillion, are procured from the Continent. The French, on the other hand, excel in the brilliancy of their varnishing, the richness of their silks, the taste of the linings, and the chasteness of the metal ornaments. Their hammer-cloth trimmings are also superior, and their carving is excellent. They procure various articles from England, viz., carriage designs, varnish, spring steel, carpets, painted floorcloths, wool rugs, &c. The jury for this class did not contain among its members a single practical coachbuilder, and hence it is not surprising to find that the awards and their classification are most eccentric. Very few builders of the first class of carriages either in London or Paris contributed to the Exhibition, as they preferred not to place the well-established reputation of their houses in the hands of jurors, who might be deceived by a mere novelty without utility, a mere "tour de force," or a display of profuse decoration. In conclusion, the author pointed out a variety of useful woods shown by our colonies, suitable for carriage building, and indicated the purposes to which particular kinds of timber might be applied.

DECEMBER 12.

"On the Progress and Results of the Under Drainage of Land in Great Britain," by Mr. J. Bailey Denton.

JANUARY 16, 1856.

"On Tonnage Registration," by Mr. Charles Atherton.

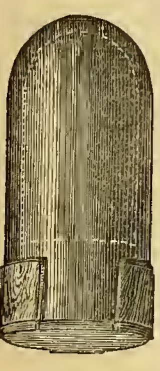
MONTHLY NOTES.

THE OLD STORY OVER AGAIN.—A correspondent, in commenting upon the value of a well-conducted periodical publication relating to mechanical inventions, makes the following remarks:—"I fear that much of the knowledge that many people who are called instructed, possess, is merely nominal, if not fallacious; whilst those who are untaught are often disposed to ignore everything mental and material that has not come under their own hands. I knew a clever watchmaker who denied the possibility of all astronomical knowledge, and an excellent shoemaker who would believe in nothing. An excellent mechanician, who had lectured much on various subjects to various classes of adults and scholars, informed me, that he was engaged by the National School Society to give a course of instruction to a body of their schoolmasters, but that he found it almost impossible to teach them, they were so ignorant and self-conceited. The same invention, which a slight acquaintance with principles would show to be absurd, is, I apprehend, made over and over again by the better class of mechanics. A gentleman, the most active member of one of the largest shipbuilding firms in London, told me, long ago, that he was perfectly pestered by inventors bringing the same improvements in his art, which had long before been found impracticable. Such applicants were not easily got rid of. At last he collected a drawerful of these inventions, and when a fresh applicant came to him, he extracted a scheme from his drawer, saying, 'Is this not pretty much the same as your invention?' This could not be denied by the mortified mechanic. 'Well, then,' said the shipbuilder, 'I can assure you that your invention has been tried long ago, and found not to answer at all.'"

HOROLOGICAL INSTRUMENTS IN THE FRENCH EXHIBITION.—The history of all decisions upon public competitions is proverbially a tale of much grumbling and discontent. The Paris display has proved to be in no way exceptional to this experience; and when we see Lord Brougham repeating in Parliament the statement, that all the principal honours for improvements in philosophical instruments had been unanimously and justly awarded to foreigners, we must admit that our mathematical instrument makers have some sound reason for a little grumbling. Mr. E. T. Loseby, a maker whose name will be recognised as that of a man well qualified to speak on the subject, thus replies to the reflections cast upon his craft in Britain:—"Very few of the large astronomical instruments of the first English makers were exhibited at all, and therefore it is unjust towards them that a report should be circulated which leads the public to infer that they had put forth their strength and been beaten. The expense of large instruments is so great, and the demand so limited, that they are seldom made except to order, and after they have been completed and fixed in observatories, they could only be removed at the inconvenience of interrupting the chain of observations that they may be employed upon, besides the risk of serious injury in their transit, the cost of rebuilding stone walls, and disturbing foundations that would require very long periods before they perfectly settled again—involving altogether too many sacrifices for the purpose of sending them to an Exhibition where their merits could not possibly be ascertained. The best thing that could, therefore, be done in such cases, was to represent the instruments by models, and models were sent from England of some of the first instruments in the world, chiefly by the astronomers in whose observatories they are erected, and to whom science is indebted for having effected some of the principal features of their construction." The following improvements were exhibited in the English section of the Paris Exhibition, showing that the most successful of our Government-tested clockwork inventions were really there:—An improvement, by means of mercury, in the compensation balance for chronometers, watches, &c., which removes a defect in the ordinary compensation that causes the chronometer to gain in the intermediate temperatures, when perfectly adjusted for the extremes, on account of the balance-spring losing elastic force at an accumulating rate over the effect produced by the compound laminæ of the balance. An improvement in clocks, by means of a circular spring, which removes the difference in the time of the pendulum's vibration in long and short arcs of oscillation, and accomplishes at a small cost more than has hitherto been effected by the most perfect and expensive *remontoires*. An improved form of the mercurial pendulum, insuring firmness of construction, portability, and preserving the mercury from oxidation and dust. An improvement, which enables an ordinary-sized astronomical clock to regulate the movements of the largest turret clock without the intervention of electricity, and substitutes for the pendulum an escapement of the large clock, the mercurial pendulum and escapement of the small one, with all its accuracy and durability. A better suspension for revolving pendulums than those previously in use, for regulating the motion of equatorials, registering apparatus, and all astronomical and other purposes requiring great uniformity of continuous motion. It would be easy indeed to show, that all the most valuable improvements in horological mechanism, both in this century and the last, have emanated from Englishmen. Chronometers have acquired their chief excellencies from the escapement and balance of Earnshaw and Arnold, whilst clocks have been equally improved by the escapement and mercurial pendulum of Graham. With the ideas of Cumming and Hardy before them, the French makers have worked out an almost interminable series of *remontoires*, of great complexity, and virtually impracticable for all but the largest class of clocks; and even here we must come back to our own artists, for the simple circular spring shown in the English section possesses all the advantages, without the drawbacks, of the *remontoires*, whilst it answers for the smaller works. The medal of honour and decoration awarded to a French maker for his chronometers have been given for English improvements, for this maker's chronometers are on the common English principle, but devoid of the more recent improvement of a supplementary compensation for extreme temperatures. Such instruments would have no chance with our chronometers in a year's observatory trial. Again, a Swiss exhibitor has carried off a prize for a balance spring which retains its form on being straightened. Now, if a spring is hard enough to keep to its figure under such a test, it will cause the chronometer to gain upon its rate. It is hardly necessary to say, that the element of a time test, which must always be the real point of decision, has been lost sight of in these examples.

ARBITRATION IN ENGINEERING DISPUTES.—An excellent example of the policy of coming to practical arbitration instead of the law courts in engineering disputes, has just occurred in connection with the affairs of the South-Eastern Railway Company. It appears that a claim by Messrs. Warton and Wardin for a considerable sum had been pending for four years, and, under Mr. M'Gregor's management, an offer had been made to settle it for £14,000. However, the matter still stood over until now, when it has been arranged by arbitration, at the suggestion of Mr. Peter Ashcroft, the chief engineer of the company. That gentleman induced the withdrawal of legal pleaders on both sides, and the case was then left to be argued before the arbiters; by him on behalf of the company, and by Mr. Warton on behalf of the claimants. The claim amounted to £28,300, on account of matters in dispute on the Tunbridge Wells and Hastings Line contract. After two days' discussion, during which both parties displayed considerable tact, and ability of a really practical nature, a decision was given for an award of £7,130. The railway directors have very properly evinced their approval of Mr. Ashcroft's management by passing a vote of thanks to him.

Captain Norton's Projectiles. — Our engraving is a perspective view, drawn to about a fourth of the actual size of Captain Norton's liquid-fire rifle-shell, as made for his four-pounder rifle cannon. The shell is cylindrical, with a hemispherical front, the forward portion being hollow, as indicated by the dotted lines, to receive the liquid fire, which is introduced through a hole at the point. After being charged, the hole is stopped with a plug of iron or wood, which may be made to screw into the shell, if of the former material. The back of the metal portion of the shell is formed with three equidistant legs or projections, between and inside which the wooden sabot is fitted. The sabot projects beyond the outer surface of the shell, between the legs, to fill the rifle grooves of the cannon, the legs and the projecting portions of the sabot being inclined, to correspond with the rifle twist of the piece. A disc of papier-maché or pasteboard covers the back of the sabot, to prevent its being split by the discharge. This shell may be used without the sabot, if the legs are cast to accurately fit the rifle grooves in the cannon, to which end they must project about an eighth of an inch from the general surface of the shell. The sabots may be made from a long piece of wood, first turned with the rifle twist upon it, and then cut up transversely into short lengths; and the wood may be made tough by being boiled in strong glue.



Captain Norton is sanguine in the hope that his cartridge, noticed by us on various occasions, is the best adapted for the needle-gun, because gun-cotton offers little resistance to the penetration of the needle; whereas gunpowder is liable to *cake*, and become such a solid mass that the needle cannot pierce it. If his expectations are realized, the needle-gun will be the most efficient of small arms, as there is no percussion appliance to put on after loading, which is a great advantage, particularly in cold weather. This cartridge, which consists of gun-cotton, with a small priming of fulminating mercury, is also most efficient for blasting purposes, whether fired by percussion or otherwise.

Marine Memoranda.—Progress of Screw-Propulsion.—The steamship trade between Glasgow and New York, broken about a year ago by the pressing of the ships into the war service, has at length been resumed. The *Edinburgh*, a screw vessel of 450 horses power, built by Messrs. Tod & M'Gregor, the originators of the old line, has inaugurated the new undertaking by taking out a cargo, consisting mainly of cotton goods. The value of the venture on this one bottom amounts to £265,000.

The *Glasgow* and the *New York*, now employed by the French government, are both expected to return shortly to their transatlantic duties.

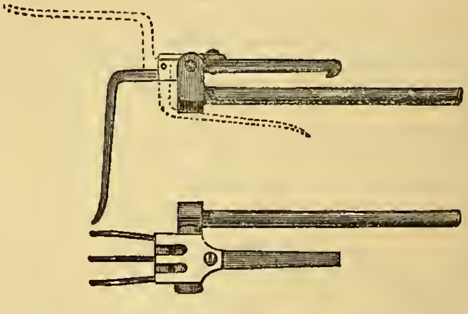
The *Himalaya* having left the Peninsular and Oriental Company's service, the *Pera*, built by Mr. More of Blackwall, has been added to the great fleet. Her engines, of 450 horses power, are by Rennie & Co., and are of the vertical trunk kind, with Lamb & Sumner's patent flue boilers. Her dimensions are—length over all, 334 feet; breadth, 42 feet 3 inches; depth, 27 feet 2 inches; height between decks in the clear, 7 feet; full tonnage, 2,630. The crank shaft is geared to the screw shaft in the ratio of two to one. Her trial, with the screw at 66 revolutions, gave a speed of $14\frac{3}{4}$ miles an hour. The internal fittings of the *Pera* comprehend all the latest improvements of the time. The saloon dining-tables, although apparently solid single ones, are capable of division, so that a double row may be laid out in a moment, accommodating a double number of persons. In this way 140 diners can be provided for. The arrangement is an invention of Mr. Taylor of the Borough. Two steam winches are fitted up on deck for shipping and discharging cargo, and on the captain's bridge is a helmsman's telegraph, for the communication of orders, in a way which must insure freedom from all misunderstanding. Cunningham's reefing topsails are also employed upon the ship. It is expected that the *Pera* will set at rest the question as to working steamers with small propelling power and fine lines.

That spirited American, Mr. Vanderbilt, has added his third and new ship, the *C. Vanderbilt*, to his line. The cost of this fine ship is calculated at 700,000 dollars. The extreme length of the hull is 335 feet, and the length at the water line is 328 feet; the breadth of beam is 49 feet; the depth of hold, 33 feet. She is 5,100 tons burden, carpenters' computation, or about 4000 tons register. The water lines are nearly straight, and the centre of displacement amidships. Indeed, the centre of the ship, the centre of weight, and the centre of buoyancy, fall within a distance of eight feet fore and aft. The main deck is of great capacity, even in comparison to the size of the ship. This is owing to the fulness of her lines. Her lower decks, of which there are two, besides the boiler deck, are of the same character. The floor is nearly flat, and is formed entirely of solid white oak, each timber being 15 by 21 inches, bolted together lengthwise of the ship, with one inch and a quarter bolts, 7 feet long. Sixty tons of these bolts are used. The frame timbers, which are principally of white oak, are placed unusually close together, and are strapped diagonally by 94 tons of wrought-iron straps, which are bolted wherever they cross each other. The planking is of oak, six inches thick. The hull weighs 2,300 tons. The steamship will be supplied with two masts, upon each of which will be placed two yards. There is no bowsprit to the vessel, and apparently but little reliance will be placed upon her sails.

Condensed Army Forage.—A commissariat officer, Mr. Penrose Julyan, has suggested the use of a novel system of preparing field forage, which, in addition to its other most obvious advantages, promises to add much to the flexibility, as we may term it, of an army. The hay, bruised oats, bran, and whatever other food is intended to be used, are all mixed together in certain proportions, and the mass is then subjected to great pressure, so as to compress a ton of food within a space of 50 cubic feet. Under this compression, the mass becomes so extremely solid, that it stands cutting by a circular saw, like wood. The saw reduces the food into square blocks, each containing a half day's ration for a horse. By this system the transport cost is vastly reduced, whilst, as the food is always fit for immediate use, all the waste and inconvenience of the old system is removed. Formerly, the hay alone took 150 cubic feet to the ton. It is said that Mr. Julyan's plan will save all the cost of packing, in tonnage alone.

Railways in America.—Up to the end of 1855, the aggregate length of railway opened in the United States amounted to 20,260 miles. A year earlier the length was 17,810 miles, thus showing a year's increase of 2,450 miles. The length of line in construction, or about to be made, is 14,000 miles, 3000 miles of this being really in active progress.

Double-Action Jointed Weft Fork.—Various plans have been proposed, from time to time, to obviate the tendency to fracture of the ingenious power-loom "weft fork," the little instrument which causes the loom to stop, when, from any cause, the weft thread of the shuttle breaks. The ordinary forks give a great deal of trouble by breaking from the chance catching of the shuttle, and from other causes. Forks with hinged prongs, stiff enough in their joint action to afford the necessary resistance for the weft thread, but weak enough to give way when a more serious obstacle is interposed, have afforded a partial preventive of disasters of this kind; but to make the improvement perfect, provision must be made for both a back and a forward joint action. This has been accomplished by Mr. Corrigan, whose fork we engrave under two views, an elevation and plan. The prongs are all separately hinged to the long eye of the holder, and they are all acted upon by a single blade spring. This spring joint is precisely like the joint of a common case-knife, the position of the prongs, when in proper working action, being that in which the knife-blade stands when half shut. In the side view, one prong only is represented in sharp lines, as in working position. The other two of the series are represented by dotted lines, one back and the other forward, in illustration of the duplex action to which we have referred. These forks have proved highly serviceable in practice. They have been tested at high speeds, and with weft as fine as 120s, with marked success.



Density of Aluminium. — The French work of scientific reference, the *Annuaire des Longitudes* for 1856, now, for the first time, states the density of this curious metallic novelty. With water as the standard of unity, melted aluminium weighs 2·50; cold, it weighs 2·67. We shall realize the extreme lightness of the metal, when we remember that gold weighs 19·56, and platina 21·53.

British Guns made by American Machinery.—The Americans, as every one knows, have lately read us some salutary lessons on the gunnery manufacture; but it is perhaps not so generally understood that American gun machinery has been imported wholesale for the production of small arms on British soil. A year or two ago, a commission of army officers and engineers was sent from this country to America, for the purpose of organizing gun factories here, from what was to be learned on the other side of the Atlantic. In following out the government's instructions, the commission engaged Mr. Burton, the chief engineer of the Harper's Ferry Armoury, to act as the superintendent of the new enterprise in this country. And in addition to this living importation of American ingenuity, complete sets of the machinery, at work in the United States armouries, were ordered to be sent over. Robbins & Lawrence, of Windsor, Vermont, were employed to build some 100 "milling machines," used for cutting the gun locks and other iron parts of the gun. This branch of the contract amounted to some 30,000 or 40,000 dollars. But the more important and intricate machinery—that for the manufacture of the gun stock—was intrusted to the Ames Manufacturing Company of Chicopee. It consists of 25 different machines, three of which are duplicates. The rest constitute "the set," and through each of them does the gun stock have to pass in the manufacture. The machinery is capable of turning out 250 stocks per day, each machine requiring the average of a minute to execute its peculiar office. The cost to our Government of this superb lot of machinery is about 50,000 dollars. Mr. Oramel Clarke, one of the best workmen in the stocking department of the armoury, has been sent to this country to take the charge of the machinery and its operation. The new government armoury, into which this machinery and its new operations are to be introduced, is at Enfield Lock, nine miles north of London. It is intended ultimately to employ 800 operatives, and turn out 500 muskets daily. Captain H. J. W. Jervis remains to look to the completion of a contract for 25,000 rifles abroad, which are in progress at the establishments of Robbins & Lawrence, at Windsor, Vermont, and Hartford.

Crystal Palace Gallery of Inventions.—We have already remarked that the directors of the Crystal Palace, in their endeavours to gratify the tastes of the public, have recently set apart one of the galleries for the reception of articles illustrating recent inventions. At present these articles are few in number, and not very important in character; but it is reasonable to suppose, that when the plan becomes better known, inventors of all kinds will hasten to avail themselves of this mode of bringing their schemes and discoveries before the public. We noticed various models and drawings illustrating railway contrivances, rails, chairs, buffers, standing apparatus &c., and some steam guages (Fenton's and Vidi's). Also specimens of Price's patent candle stove, Fuller's india-rubber springs, Hanson and Chadwick's water-meter, various miners' lamps, gas regulators, and a model of Davidson's floating breakwater; several contrivances relating to ventilation, the cure of smoking chimneys, and stench traps are exhibited, as well as models of stoves, weighing machines, drying apparatus, and many devices bearing upon in-door comfort.

Metropolitan Depôt for the Productions of Patentees and Manufacturers.—Mr. C. F. Bielefeld, the papier-mache manufacturer, has opened his premises, 16 Wellington Street North, Strand, as an exhibition, and wholesale mercantile depôt for patented inventions, and general articles of manufacture. The central position and excellence of the rooms, give the experiment the fairest chance of success. The proposed terms on which articles are to be received, are one shilling per square foot annually for wall space, and one shilling per annum per cubic foot for goods in bulk. Offices are provided for wholesale transactions, the depositors or their representatives becoming bound to certain regulations which seem just and reasonable.

The Fine Arts at the Paris Exhibition.—The following countries are contributors to the *Exposition des Beaux Arts*, the figures annexed showing the number of pieces respectively contributed:—France, 2729; Great Britain, 771; Belgium, 271; Austria, 222; Prussia, 214; Holland, 134; Spain, 124; Switzerland, 113; Bavaria, 73; Sweden and Norway, 60; Denmark, 54; United States, America, 43; Portugal, 28; Sardinia, 28; Saxony, 28; Roman States, 26; Baden and Nassau, 22; Wurtemburg, 20; Hanseatic Towns, 19; Greece, 18; Hesse, 10; Tuscany, 8; Kingdom of Naples, 7; Peru, 5; Turkey, 3; Hanover, 3; Luxemburg, 2; Mexico, 1. A perusal of this list will suggest some reflections. Thus the activity of the little State of Belgium is very remarkable, and contrasts curiously enough with Turkey, at the opposite end of the scale. Italy, with all its museums and artistic traditions, contributes only 69 pieces, about one-fourth of the number sent by Belgium; whilst the whole of Germany has sent but 519 contributions, less by one-third than the number sent by Great Britain. America in this, as in other departments of the Exhibition, has been careless how her name would stand. She has only sent 43 pieces, fewer by 17 than those sent by Sweden and Norway, and fewer by 11 than the contributions of Denmark. To conclude, we show, in a tabular form, the classes to which the contributions of the six chief contributing countries belong:—

	Oil paintings and water-colour drawings.	Sculpture.	Engravings and woodcuts.	Lithographs.	Architectural drawings.
France, ...	1869	386	191	95	188
Great Britain,......	378	77	166	22	128
Belgium,............	224	28	15	2	2
Prussia, ...	137	52	16	7	2
Austria, ...	107	93	16	0	6
Holland, ...	100	3	26	0	5

Patents in America.—The report of the American Commissioner of Patents, as to the business of his office in 1854, has been recently made public, and we glean from it the following particulars:—The patents issued in 1854 were 1902, against 958 in 1853, and 1020 in 1852. The sums received from patentees amounted to 163,789 dollars, whilst the expenditure amounted to 167,146 dollars. The number of applications for patents made during 1854 was 3324, of which only 69 had been undealt with, so that the number of rejected applications bore a considerable proportion to the whole. The report again touches on the subject of the difference in the amount of fees paid by American citizens, and those paid by aliens. The Commissioner, in his former report, expressed himself as opposed to the policy which dictated such difference, and he now states that subsequent reflection had only confirmed that opinion. At the present time no patents are granted in Canada. All machines invented in the United States can be made and used in Canada without any licence from the American patentees, and the products of those machines can with little trouble or expense be taken into the American market, to compete with like commodities manufactured there by persons who are obliged to pay for the right to use the patented machinery. This, of course, is felt to operate disadvantageously against the American manufacturers. It is understood, however, that if the American government would make the fees payable by foreign inventors less onerous, the Canadian government would take steps to enable American inventors to obtain patents in Canada. This affords an argument in favour of the Commissioner's views, which he does not fail to make use of. Mr. Charles Mason, whose report we have been reviewing, has recently resigned the office of Commissioner, for reasons which we have not seen given. He had only held the office for two years, but during that time had exhibited so much energy and ability, combined with urbanity, as to have won the respect of all who came in contact with him. His successor has not yet been appointed, we believe.

What Manchester is Made of.—The composition of a great industrial city, when accurately known, presents much that is of the highest interest. Such digests picture to us exactly what is going on in our most productive localities, the proportions of the different manufacturing trades, and they develop the real sources of what is more than all other, manufactured wealth. In Manchester, up to the end of 1854, the buildings were thus apportioned:—Cotton mills, 107; silk mills, 11; worsted mills, 3; smallware mills, 19; print works, 7; dye works, 29; hat manufactories, 12; machinists, 55; foundries, 43; lead works, 5; paper works, 3; saw mills, 40; corn mills, 8; miscellaneous workshops, in various trades and manufactories, 931; warehouses, 1,708; dwelling-houses, 56,099; shops used as dwelling-houses, 6,483; shops not used as dwelling-houses, 889; places of worship, 124; public and private schools, 319 (many of these are included with the dwelling-houses, places of worship, and public institutions); barracks, 1; banks, 11; markets, 10; theatres, 2; railway stations, 7; gas stations, 4; workhouses, 3; infirmary, fever hospitals, and dispensaries, 7; night asylums, 2; lock hospital, 1; penitentiary, 1; public institutions, 14; public buildings, 35; baths and wash-houses, 8; breweries and distilleries, 167; slaughter-houses, 141; buildings used as offices, 505; livery stables, 43; miscellaneous buildings, such as sheds, &c. not workshops, 1,772: total buildings, 69,629. Of this number, 2,219 were "erected and completed" during the year; 1,692 of them being in use, and 527 not in use, on the 31st December. The buildings so erected were the following:—Saw mills, 3; workshops, 24; warehouses, 12; dwelling-houses, 1,970 (485 of them not in use); shops, 171 (36 not in use); churches or chapels, 3; hat manufactory, 1; slaughter-houses, 3; offices, 11; miscellaneous, 21. Three cotton mills, a machine shop and foundry, a gas station, seven warehouses, three dwelling-houses, eleven shops, and one brewery, were enlarged during the year. The following (400) premises were in course of erection on the 31st December—3 warehouses, 369 dwelling-houses, 20 shops, 4 churches or chapels, 2 schools, and 2 miscellaneous; and a silk mill, a machine shop, and a foundry were being enlarged.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded August 29.

1951. Charles P. Rosson, Manchester—Certain improvements in machinery or apparatus employed for dressing and finishing textile fabrics, by the application of a new material in the place of hogs' bristles or wire cards, hitherto employed therein.

Recorded September 6.

2018. Charles Pryse, Birmingham, and Paul Cashmore, West Bromwich, Staffordshire—Certain improvements in repeating fire-arms.

Recorded October 2.

2197. William Horton, Birmingham—Improvements in the breech part of fire-arms.

Recorded October 18.

2336. Samuel Statham, Islington—Improvements in electric telegraph cables.

Recorded November 9.

2520. John Olive and William Olive, Woolfold, near Bury—Improvements in the manufacture of wheels for railway and other purposes.

Recorded November 13.

2550. Robert Tempest, James Tomlinson, Richard Hampson, and John Hampson, Rochdale—Certain improvements in looms for weaving, which improvements are applicable to working the valves of steam-engines.

Recorded November 16.

2584. William Cooke, 49 Frederick-street, Gray's-inn-road—An improved apparatus for cleaning knives and other cutlery.

Recorded November 17.

2596. Joseph Shaw, 22 New King-street, Hull—Improvements in the prevention of accidents arising from collisions on railways.

Recorded November 19.

2599. Thomas Culpin, 25 Royal-hill, Greenwich—An improved apparatus for regulating the supply and discharge of fluids and gases.
2601. Josiah Pratt, Bath-street, City-road, and Thomas Radcliffe, Shaftesbury-street, Hoxton—Improvements in the manufacture of brushes.
2603. John Silvester, West Bromwich, Staffordshire—Improvements in steam guages and safety valves.
2605. John M'Nicol, Manchester—Improvements in machine or cylinder printing.
2607. Michel P. A. Gillardeau, 4 South-street, Finsbury, and Paris—Invention of a new motive power.

Recorded November 20.

2609. Theodore Schwartz, New York, now of 67 Gracechurch-street—Improvements in drying, heating, and melting solid and plastic bodies.
2611. George Geyelin, 13 Melville-terrace, Torriano-avenue, Camden-road—Invention of propelling vessels by means of pistons, which he calls anti-friction propellers, to supersede paddle wheels, screws, and all other contrivances at present in use.
2613. Francis Puls, Soho-square—Invention of a new electric light and heat.
2615. Peter Armand le Comte de Fontaine Moreau, 4 South-street, Finsbury, and Paris—Improvements in apparatus for preventing horses from running away.—(Communication.)
2617. Edward O. W. Whitehouse, Brighton—Improvements in electro-telegraphic apparatus, parts of which are also applicable to other purposes.
2619. David S. Price, 2 South Moulton-street, and Edward C. Nicholson, 3 Newington-crescent—Improvements in the manufacture of cast-steel.
2621. George S. Tolson, Robert H. Tolson, Joseph S. Tolson, and Thomas Irving, all of Dalton—Improvements in producing metallic lustre to yarns and fabrics.—(Communication.)

Recorded November 21.

2624. William Cooke, 49 Frederick-street, Gray's-inn-road—Improvements in gas and solar light reflectors.
2625. Armand J. B. Louis de Marcesheau, Paris—Improvements calculated to increase the efficiency or working power of steam-engines.
2627. William Munslow and Henry Wallwork, Miles Platting, Lancashire—Improvements in railways.
2629. Thomas W. G. Treehy, 1 Westbourne-terrace Villa, Westbourne-terrace North, Paddington—Improvements in revolving fire-arms.

Recorded November 22.

2631. John Roberts, jun., Whitechapel-road—Invention of a machine or apparatus for cooling tobacco during the process of manufacture.
2633. Edmund Calvert and Sidney A. Smith, Walton-le-Dale, Lancashire—Certain improvements applicable to carding engines.
2636. Frederic Lotteri, Bergamo, Lombardy, now residing in London—Invention of obtaining fibre from the bark of trees of the morus family or class, and the application thereof to the manufacture of paper and textile materials, and for other useful purposes.
2637. Charles T. Dunlop, Glasgow—Improvements in the manufacture of or production of artificial oxide of manganese.
2639. Charles May, Great George-street, Westminster, and Paul Prince, Derby—Improvements in the manufacture of spikes and trenails.

Recorded November 23.

2643. John H. Hutchinson, East Retford, Nottinghamshire—Improved machinery for converting rectilinear motion into rotary motion.
2645. John Johson, Litchurch, Derbyshire—Improvements in the manufacture of railway chairs.

Recorded November 24.

2649. Jean Lohstein, 36 Rue de l'Echequier, Paris—Improvements in sewing machines.
2651. Robert Knowles, Chorlton-upon-Medlock, Lancashire—Improvements in winding on in certain machines for spinning cotton and other fibrous materials.
2653. Charles Sanderson, Sheffield—An improvement in the manufacture of iron.

Recorded November 26.

2655. Louis J. F. Margueritte, Paris—Improvements in precipitating certain salts.
2656. Denis Jonquet, 63 Mina-road, Old Kent-road, Southwark—Improvements in the blades of mechanical cutting machines, and in the blades of single or double handled cutting instruments, and in the blades of ordinary and mechanical shears and scissors, and in the handles and springs for the same.
2657. John Wilkes, Birmingham—An improvement or improvements in the manufacture of tubes of copper and alloys of copper.
2659. François Coignet, 90 Rue Hauteville, Paris—Certain improvements in the use and preparation of plastic materials or compositions to be used as artificial stone, or as concrete or cement for building and other purposes.
2661. Frederick Osborne, Aldersgate-street—Improved machinery for pressing, smoothing, or finishing garments or parts of garments.
2663. John J. Clero de Clerville, Newman-street, Oxford-street—Improvements in preparing oil with other matters for painting.—(Communication.)
2665. Robert Bell, 93 Glassford-street, Glasgow—Improvements in the manufacture of woven fabrics when made of wool and cotton, or of wool, cotton, and silk.

Recorded November 27.

2667. William E. Newton, 66 Chancery-lane—Improvements in breech-loading fire-arms.—(Communication.)
2669. Hiram Hyde, Truro, Nova Scotia—An improved manufacture of lubricating oil.—(Communication.)
2671. Charles Rice, Massachusetts, U.S.—A new or improved method of manufacturing boots or shoes.—(Communication.)
2673. Charles Rice, Massachusetts, U.S.—A new or improved process of preparing cloth so as to render it nearly, if not entirely, impervious to water, but not so to air, such cloth being particularly useful in the manufacture of boots and shoes, or various other articles of dress or utility.—(Communication.)
2675. George L. Stott, St. George's, Gloucestershire—Improvements in the manufacture of carbonate of soda.
2677. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in windlasses, capstans, and other purchases, parts of which are applicable to the transmission of motive power.—(Communication from Louis F. F. David, Havre, France.)
2679. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture or preparation of india-rubber and gutta percha, and in the applications thereof.—(Communication from Henri V. Wacrenier, Paris.)
2681. George Richardson, Craig's-court, Charing-cross—Improvements in chain cables and other chains.—(Communication.)

Recorded November 28.

2683. Charles J. B. Barbier, Paris—An improved kiln for burning or firing pottery, bricks, tiles, and other earthenware.
2685. Benjamin Rosenherg, New Charles-street, City-road—Improvements in protecting metallic and other surfaces from corrosion and decay.—(Communication.)
2687. Richard A. Brooman, 166 Fleet-street—Improvements in the manufacture of sand, emory, and glass papers, and in the machinery employed therein.—(Communication.)
2689. Samuel Wolff, Independence, Missouri, U.S.—Improvements in obtaining motive power.
2690. James Walker, Leeds—Improvements in the manufacture of textile fabrics.
2691. Charles Clarke, Farm-lane, Walham-green, Fulham—Improvements in applying roughings to the feet of horses.

Recorded November 29.

2693. Thomas Symons, Flushing, Cornwall—Improvements in the permanent ways of railways, and in the wheels rolling thereon.
2696. Charles M. Archer, 3 St. James'-gardens, Haverstock-hill, Hampstead-road—Invention of a new material for the manufacture of paper.
2697. Alfred V. Newton, 66 Chancery-lane—An improved process of manufacturing hats.—(Communication.)
2698. George North, Lewisham-road, Greenwich—An improved portable apparatus for supporting and folding heads, tilts, coverings, and awnings of wheel carriages, marine vessels, goods, and ways.
2699. Pierre L. Bergeon, Paris—An improved spitting-box or spittoon.—(Communication.)

Recorded November 30.

2701. Henry T. Humphreys and James Louehry, Kilmacow Mills, Waterford—Improvements in machinery or apparatus for cleaning wheat.
2703. Auguste Dusautoy, Boulevart des Italiens, Paris—Invention of new and useful machinery for cutting cloth and other substances.
2705. Edward J. Davis, 64 West Smithfield—Improvements in preparing food for horses and other animals.

Recorded December 1.

2707. Edmund A. Pontifex, Shoe-lane—Improvements in furnaces.
2709. William Needham and James Kite (secundus), Vauxhall—Improvements in machinery or apparatus for expressing liquids or moisture from substances.
2710. John Gardner, 51 Mortimer-street, Cavendish-square—Invention of a method of treating tea for economizing its use and transport.
2713. William A. Woodley, Taunton, Somersetshire—Improvements in the manufacture of paper bags.

Recorded December 3.

2714. George Harrison, Burnley, and William Mitchell the younger, Hoarstone Lodge, near Burnley—Improvements in machinery for roving, spinning, and winding worsted, cotton, and other fibrous materials.
2715. David Anderson, Strandtown House, County Down—Improvementa in machinery or apparatus for the preparation or manufacture of felt and other fibrous materials.
2716. Christian Mayer, New York, U.S.—Improvements in hair-trigger locks for fire-arms.
2718. Westley Richards and Joseph R. Cooper, Birmingham—An improvement or improvements in breech-loading fire-arms.
2719. William Rowan, Belfast—Improvements in steam-engines.
2720. Jules Roth, Mulhouse, France, now of Manchester—An improvement in rollers employed in spinning machinery, and in other parts of machinery used in the treatment of fibrous materials.
2721. Alexander Watt, Dean-street, Soho—An improvement in coating iron and steel with zinc.
2722. James Leitch, 1 Ellenborough-street, Liverpool—Certain improvements in melting and blowing up sugars.

Recorded December 4.

2723. Samuel Garu, Sevenhampton, Wiltshire—An improved tipping apparatus applicable to carts and other vehicles.
2724. Etienne A. N. Bréeheux, Paris—An improved axletree for carriages.
2726. William Foot, Wellington, Somersetshire—Invention of an instrument for moving and stopping trucks and other carriages on railways.
2727. Joseph Barling, 7 High-street, Maidstone—An improvement in the manufacture of paper by the application of a root not before used for the purpose.
2728. Jean Davoust, Hotel des Invalides, Paris—Improvements in cartridges.—(Communication.)
2729. William Knight, St. Marylebone—An improved mode of cutting out or shaping materials to be employed in making over-coats or other similar articles of dress.
2730. John Marsh, Nottingham—Improvements in the manufacture of looped and piled fabrics.

Recorded December 5.

2731. Adam Bullough, Blackburn—An improved lubricator for looms.
2732. John Moffat, Birmingham—An improvement or improvements in the manufacture of metallic spoons, forks, and ladles.
2733. William G. Plunkett, Belvidere-place, and John Bower, Lower Ormond-quay, Dublin—Invention of the manufacture of fibres or threads for textile fabrics and cordage, also of paper, mill-board, and other similar boards, from plants or portions of plants not hitherto used for these purposes.
2734. William Nunn, 7 Church-street, Hackney—An improved table, washstand, mirror, &c., combined in one piece of furniture.
2736. William Beatson, Rotherham—Improvements in treating borates of lime and magnesia, and a new composition formed therewith, suitable for glazing and other purposes for which borax has been or may be employed.
2737. Cæsar Heilmann, 22½ Milk-street, Cheapside—Improvements in grates or furnaces for steam-boilers.
2738. William Smith, 82 Margaret-street, Cavendish-square—Improvements in apparatus for regulating the supply of air to furnaces.
2739. William H. Smith, Wellington Chambers, Cannon-street West—An improved construction of fastening, applicable to gaiters, stays, and other like articles.
2740. Alfred V. Newton, 66 Chancery-lane—Improvements in apparatus for dressing cloth.—(Communication from Mr. Nos d'Argenee.)

Recorded December 6.

2741. Jonas Marland and Samuel Marland, Sun Vale Iron Works, Walsden, Lancashire—Certain improvements in power looms.
2742. Charles Hawker, Fishbourne, Isle of Wight, and Thomas P. Hawker, War Prison, Plymouth—An improved method of manufacturing cartridges.
2743. William G. Wilson, Penton-place, Newington Butts—Invention of a pneumatic moderator.
2744. William Mosley, Salford, Lancashire—Improvements in machinery or apparatus for stretching and finishing woven fabrics.
2745. Arthur Paget, Loughborough, Leicestershire—Improvements in machinery or apparatus for the manufacture of looped or other fabrics.
2746. John Barrow, jun., Manchester—An improved process of manufacturing soda and sulphuric acid.
2748. Thomas Dunn, Glasgow—Improvements in fire-arms.
2749. James Rock, jun., Hastings, Sussex—Improvements in the construction of tents, huts, and portable buildings.
2750. John Cornes, Swan-lane—An improved mangle or press, parts of which are applicable to rollers employed for pressure purposes generally.
2751. Thomas Chaffer, Liverpool, and Jonah Ellis, Vulcan Foundry, near Warrington—Improvements in machinery for sawing and cutting slate, stone, coal, salt rock, or other minerals.
2752. Johannes Nenensehwander, Harvstehude, near Hamburg—Certain improvements in the process of preparing what is called "Swiss whey" from milk.
2753. Rudolph Bodmer, 2 Thavies-inn—An improved planimeter.—(Communication from Jacob Amsler, Schaffhausen, Switzerland.)
2754. Thomas R. Crampton, Adelphi—An improvement in furnaces, and in apparatus for supplying fuel thereto.
2755. Angier M. Perkins, Francis-street, Gray's-inn-road—Improvements in apparatus for generating steam.
2756. Frederick S. Thomas and William E. Tilley, 6 Kirby-street—Improvementa in producing aluminium and its alloys, and in plating or coating metals with aluminium, and alloys composed of aluminium and other metals.
2757. Angier M. Perkins, Francis-street, Gray's-inn-road—Improvements in warming buildings and apartments by hot water.

Recorded December 7.

2758. Jean J. E. F. Kuister, Lyona, France—Improvements in raw-silk winding machinery.
2759. Antoine Latta, Metz, France—Invention for preparing gutta percha in combination with other substances, applicable to various purposes.
2760. Henry Hart, Dover—Invention of a ship leakage indicator.—(Communication.)
2761. David Dick, Paisley—Improvements in machinery to be used in finishing cloth and textile fabrics.

2762. James Gardner, Plaistow, and Henry Gardner and John C. Gardner, Leytonstone-road, Essex—Improvements in glasses as applied for the transmission of light.

2763. Hndson Cranston, Sunderland, Durham—An improved method of manufacturing lozenges.

2764. Charles Lenny, Croydon—Improvements in carriages.

2766. John A. Williams, Baydon, Wiltshire—Improvements in machinery or apparatus for cultivating land.

2767. James Leitch, Liverpool—Improvements in melting, blowing up, and filtering sugars, and other saccharine matters.

2768. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of iron.

2769. John Gray, Liverpool—Improvements in azimuth and amplitude instruments.

2770. Charles E. Green, 13 Blandford-street, Portman-square—Improvements in huts, tents, and camp hospitals.

2771. Herman John Van den Hout and Ebenezer Brown, Kentish-town—Improvements in utilising leather shavings.

Recorded December 8.

2772. Joseph Hacking, Bury, Lancashire—Improvements in machinery for supplying fuel and air to furnaces.

2773. Charles F. J. Fonrobert, Berlin—Invention of an artificial leech and a sucker.

2774. John Radcliffe and Thomas V. Favell, Rotherham—Improvements in machinery or apparatus for cutting sugar and other substances.

2775. William Norton, Kirkburton, Yorkshire—Improvements in weaving pile fabrics.

2776. Andrew Tevindale, Liverpool—Improvements in propelling and in the construction of steam or other vessels.

2777. François Devos, Paris—Improvements in preparing and tanning hides and skins.

2778. Andrew Maclure, 37 Walbrook—Improvements in lithographic printing-presses.

Recorded December 10.

2779. Joseph Wrigley and Jacob Norcliffe, Oldham—Improvements in shuttles, and in the method of using the same.

2780. John Hall, the younger, Mount Pleasant, Walmersley, near Bury—Improvements in jacquard looms.

2781. James Cocker, Liverpool—Improvements in the manufacture of wire.

2782. Thomas Heppleston and John Hunter, Manchester—Certain improvements in machinery or apparatus for stretching and finishing yarns or threads.

2783. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the manufacture of safety paper.—(Communication from Victor Courboulay, Paris.)

2784. David Parsons, Pensnett, near Dudley, Worcestershire—An improved brake for arresting or retarding at will the motion of locomotive and other engines and revolving machinery.

2786. Richard A. Brooman, 166 Fleet-street—Improvements in manufacturing gas from peat, and in treating hydrogen gas, in order to render it illuminating.—(Communication from C. M. I. de Flers, Paris.)

2787. Josiah G. Jennings, Great Charlotte-steeet, Blackfriars-road—An improvement in the arrangement of the overflow pipes of baths, wash-hand basina, and other vessels.

2788. Josiah G. Jennings, Great Charlotte-street, Blackfriars-road—Improvements in connecting earthenware rain-pipes and soil-pipes of water-closets, and in valve water-closets.

2789. Josiah G. Jennings, Great Charlotte-street, Blackfriars-road, Surrey—An improvement in the rising pipe and suction valves of pumps.

Recorded December 11.

2790. Bernard Hughes, 67 Gracechurch-street—Invention of a machine for making spokes and tool handles.—(Communication.)

2791. Bernard Hughes, 67 Gracechurch-street—Invention of a knot-tying sewing machine.—(Communication.)

2793. Jean M. Préand, Lyons, France—Certain improvements in india-rubber springs.

2794. Alexandre Tolhausen, 7 Duke-street, Adelphi—Certain improvements in mariners' and land compasses.—(Communication from John Prime, Washington, U.S.)

2796. James Cliff, Burton-on-Trent, Staffordshire—Improvements in or additions to furnaces.

2797. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—An improved apparatus for discovering the leakage or escape of gas.—(Communication from Etienne A. Maccand, Paris.)

2798. Reuben Levy, Manchester—An improvement in wearing apparel.

2799. Robert A. Whytlaw and James Steven, Glasgow—Improvements in weaving.

2800. René S. Bonët and Henri E. I. Douein, Paris—Improvements in the preservation of meat and other animal substances serving for food.

2801. Alfred V. Newton, 66 Chancery-lane—Improved machinery for manufacturing bolts.—(Communication.)

2802. Alexander Forot, Paris—Improvements in parasols.

2803. Samuel Clarke, Albany-street, Regent's-park—Improvements in lanterns for affording light, and for cooking.

2804. Rogers Ruding, 51 Bunhill-row—An improvement in printing silks and other woven fabrics with gold and other metal leaf or powder.

Recorded December 12.

2806. Martin Billing and Walter G. Whitehead, Birmingham—Invention of a new or improved waterproof fabric or material.

2807. Isaac Beardsell, Huddersfield—Improvements in the finishing of mohair cloths and other textile fabrics, and in the machinery employed for that purpose.

2808. George H. Hay and David S. Hay, Edinburgh—Improvements in photographic pictures.

2809. Robert Midgeley, Salterlee Mill, and George Collier, Halifax—Improvements in preparing worsted, mohair, alpaca, cotton, and other yarns.

2810. William Leighton, Newcastle-upon-Tyne—Improvements in paddle-wheels.

2811. Richard Holben, Barton, Cambridgeshire—Improvements in apparatus for chapping barley.

2812. Thomas Rickett, Stony Stratford, Buckinghamshire—Improvements in pressure guages.

Recorded December 13.

2813. John Roberts, Falmouth—Improvements in machinery for moulding bricks and tiles.

2814. David Hart, Trinity-square—Improvements in signalling or communicating between parts of a railway train, and in the instruments and apparatus employed for such purpose.

2815. Alphonse L. Poitevin, Paris—Improved photographic printing.

2816. Alphonse L. Poitevin, Paris—Improved photographic engraving.

2817. James Murdoch, 7 Staple-inn—Invention of a process for separating the oleine from the stearine of fatty and oleaginous bodiea, and for the extraction of oil from oleaginous grains and from olives.—(Communication.)

2818. George Skelton, Lambeth—An improved projectile.

2819. John Little, Glasgow—Improvements in heating and cooking apparatus.

2820. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in apparatus for containing and distributing aeriform fluids under pressure.—(Communication from John Cockerill of Seraing, Belgium.)

2821. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in apparatus for containing compressed air or gases, and in the application of the same to the obtainment of motive power.—(Communication from the company "John Cockerill," Seraing, Belgium.)

2822. George H. Nicoll, Dundee—Improvements in fire-places or heating apparatus.

Recorded December 14.

2823. John W. Friend, Freemantle, Southampton—An improved registering log and deep sea lead.

2824. William Philippi, 159 Regent-street—Improvements in coating iron with tin.

2825. Alfred Krupp, Essen, Prussia—Improvements in railway and other wheels, and in the method of, and machinery for, manufacturing the same.

2826. George T. Bousfield, Sussex-place, Loughborough-road—Improvements in machinery for the manufacture of cut pile fabrics.—(Communication.)

2827. Charles J. Todd and Robert Pinkney, Long-acre—Invention of a balance pen.

2828. Edward O. W. Whitehouse, Brighton—Improvements in apparatus for measuring fluids.

2829. Peter Haworth, Manchester, and Alexander Forrest, Birmingham—An improvement in the manufacture of belts, bands, braces, and other similar articles of wearing apparel.

Recorded December 15.

2830. William H. Newman, 45 Cannon-atreet-road—An improved fire-lighter.

2831. Leonard Clayton, Unsworth, Lancashire—Improvements in machinery for dressing yarn.

2832. Thomas Warren, Glasgow—Improvements in the manufacture and moulding or shaping of glass.

2833. John Aspinall, Limehouse—Improvements in machinery for curing sugar and extracting moisture therefrom, parts of which are applicable to separating liquids and moisture from substances containing the same.

2834. Edward B. Hutchinson, Moorgate-street—An improved apparatus for forming and cutting elliptical figures.

2837. Agnes Wallace and John Wallace, Netherplace Bleach Works, Renfrewshire—Improvements in bleaching, washing, or cleansing textile fabrics and materials.

2839. William Clay, Liverpool—Improvements in the manufacture of bar iron.

2840. Samuel Stewart, 28 Clements-lane—An improved combined engine and gas exhauster, and also improvements in the valves of such exhausters.

2841. William Clay, Liverpool—Improvements in the manufacture of iron and steel.

2842. Paul M. Salomon, Rue Neuve, St. Eustache, Jacques L. Montgazan, Rue de Bondy, and Charles M. Joseph de Flers, Rue Lafitte, all in Paris—Improvements in the manufacture of gas from coals, and in the production of bituminous coke in that manufacture, and also in the apparatus connected therewith.

Recorded December 17.

2843. Samuel F. Cottam, Manchester—Certain improvements in mules for spinning cotton and other fibrous materials.

2844. George Collier and John Crossley, Halifax, and James W. Crossley, Brighouse, Yorkshire—Improvements in apparatus employed in drying and stretching woven fabrics.

2845. Charles Bracegirdle, Congleton, Cheshire—Improvements in the manufacture of bolting cloths employed in dressing flour.

2846. Henry Stewart, Baker-street—Invention of a machine or apparatus for cleaning and polishing forks, spoons, and other like curved articles.

2847. John L. Jeffree, Blackwall—Improvements in or additions to furnaces.

2848. Omrod C. Evans, New York, U.S.—Improvements in digging machinery.

2849. Frederick W. East, 185 Bermondsey-street—Improvements in waterproofing and enamelling textile and other fabrics, in imitation of and to be used in lieu of leather, and for other similar purposes.

2850. George G. Golding, Gray's-inn-road—Improvements in boilers for heating, warming, or raising steam.

2851. William Sangster, Cheapside—Improvements in the manufacture of stays and corsets.

2852. James Leitch, 1 Ellenborough-street, Liverpool—Improvements in filtering sugars and other saccharine matters.

2853. William Hemsley, Melbourne, Derbyshire—An improvement in the manufacture of elastic pile fabrics.

2854. Jean J. Fontaine, Paris—Improvements in the manufacture of steel.

2855. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in ships' tillers.—(Communication from Louis F. F. David, Havre, France.)

2856. Andrew Small, Glasgow—Improvements in marine compasses and in apparatus applicable thereto.

2857. William Wilkinson, Nottingham—Improvements in machinery employed in the manufacture of looped fabrics.

Recorded December 18.

2858. Christian R. Wessel, 25 Fitzroy-square, New-road, and George Bowden, 1 Little Queen-street, High Holborn—Invention for joining elastic webbing into indissoluble bands.

2859. Alexandre Tolhausen, 7 Duke-street, Adelphi—An improved harvesting machine.—(Communication.)

2860. John P. Humaston, Newhaven, U.S.—Improvements in instruments for composing and transmitting telegraph messages.

2861. Chriatopher Nickels, Albany-road, Surrey, and James Hobson, Leicester—Improvements in the manufacture of pile fabrics.

2862. David L. Price, Beaufort, Brecknockshire—Improvements in electric telegraphs, and in appliances connected therewith, as applied to railway trains and fixed stations.

2863. Alfred V. Newton, 66 Chancery-lane—An improved mode of manufacturing wrought-iron cannon.—(Communication.)

2864. Hiram Hyde, Truro, Nova Scotia—An improved mode of purifying alcohol or alcoholic spirits.—(Communication.)

2865. Alfred V. Newton, 66 Chancery-lane—Improvements in washing machines.—(Communication.)

2866. Edward Davies and John M. Syers, Liverpool, and Charles Humfrey, Camberwell, Surrey—Improvements in distilling resinous, bituminous, fatty, and oily matters, and in the treatment of certain products therefrom.

2867. Frederick R. A. Glover, Bury-street, St. James'—An improved instrument or apparatus for taking angles, and measuring lines, surfaces, and solids, and ascertaining the variation of the needle.

2868. Frederick R. A. Glover, Bury-street, St. James—Improvements in the construction of breakwaters, sea-walls, and other structures, or foundations of structures, which lie partially or entirely under water.

Recorded December 19.

2869. Joseph Cartwright, Hyde, Cheshire—Improvements in taps or valves.

2870. George Ross and Thomas Wilka, Birmingham—New or improved machinery for the manufacture of bolts, rivets, spikes, screw-blanks, screws, nuts for screws, and washers.

2871. Richard Ruston, Birmingham—Improvements in the construction of anchors, and appendages to be used therewith.
2872. John Hadden, Henry Hadden, Frederick J. Hadden, and Charles S. Hadden, Nottingham—Improvements in circular frames for the manufacture of ribbed fabrics.
2873. Josiah Sanders, Bristol—Improvements in trusses for supporting parts of the human body.
2874. Henry R. Abraham, 11 Howard-street, Strand—Improvements in carriages, and in certain appurtenances and appendages which belong to those used as hospital conveyances or ambulances.
2875. George Harvey, Charlotte-street, Portland-place—Improvements in portfolios.

Recorded December 20.

2876. Robert Walker, Eccleston, near Prescot, Lancashire—Improvements in applying power to and in machinery for raising and lowering coals and other articles from and into mines.
2877. Robert W. Sievier, Upper Holloway, Middlesex—Improvements in guns and pieces of ordnance, and the projectiles thrown from them for the purposes of war.
2878. Andrew Shanks, 6 Robert-street, Adelphi—Certain improvements in instruments for indicating pressures.
2879. James Fleming, jun., Newlands Fields, Renfrewshire—Improvements in bleaching, washing, cleansing, and preparing textile fabrics and materials.
2881. Evan Evans, South Wales—Improvements in combining and fixing railway bars.
2882. George T. Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in machinery for splitting leather.—(Communication.)
2883. Philip Antrobns, Chepstow, Monmouthshire—Improvements in preserving and packing flour.
2884. John Barcroft, Hanley, Staffordshire—An improvement in the materials to be used in the manufacture of baskets and basket work.
2885. Alexander C. L. Devaux, King William-street—Improved machinery for crushing and grinding vegetable and other substances.
2886. Louis R. Bodmer, 2 Thavies Inn—Improvements in hydraulic seed-crushing machines or oil presses.

Recorded December 21.

2887. David D. Kyle, Albany-street, Regent's-park—Invention of a method of communicating motion.
2888. Jean B. E. Saffroy, Bordeaux, France—An improved break for railway carriages.—(Communication.)
2889. John Watson, Glasgow—Improvements in the manufacture or production of articles of ladies' dress.
2890. Thomas E. Merritt, Maidstone, Kent—Improvements in breech-loading ordnance and fire-arms.
2891. Bernard Hughes, Rochester, New York, U.S., now of 67 Gracechurch-street—Invention of a mode of mingling the vapour of bisulphuret of carbon and steam, and applying them as a motive power.
2892. Matthew Tomlinson, Culcheth, Lancashire—An improved medical plaster.
2893. Charles J. Appleton, Manchester—Improvements in machinery or apparatus for knitting.—(Communication.)
2894. James Murdoch, 7 Staple-inn—Improvements in machines or apparatus for working chain-stitch embroidery.—(Communication.)
2895. Edward Tyer, Cornhill—Improvements in telegraphing or communicating by means of electricity.
2896. Henry Francis, 456 West Strand—Improvements in apparatus for cutting out parts of garments.
2897. Charles Glover, Lincoln—Invention of removing snow from a line of railways.
2898. William J. Curtis, 1 Sehbon-street, Islington—Improvements in fog signals, and in laying the same upon the rails of railways.

Recorded December 22.

2900. Myles Kennedy, Ulverstone, and Thomas Eastwood, Preston—Improvements in pump buckets, which improvements are also applicable to lift-pumps, air-pumps, and all similar apparatus.
2902. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in furnaces for steam-boilers and other heating purposes.—(Communication.)
2904. Christopher Dresser, Waterloo-cottage, Waterloo-street, Hammersmith—Improvements in the mode of effecting what is called "nature printing."
2906. Edward Rowcliffe, 2 Gloucester-terrace, West-grove, Blackheath—Improvements in the manufacture of blocks or slabs for paving or building purposes.
2908. David Dick, Paisley—A new or improved regulator for gas.

Recorded December 24.

2910. Frederic Holdway, 12 Mount-street, Grosvenor-square—Improvements in carriages and various parts of the same.
2912. Thomas Cowburn and George W. Muir, Manchester—Improvements in steam boilers, and in valves and parts connected therewith.
2914. Christian E. Offhaus, Newark, New Jersey, U.S.—Improvements in rotary steam engines.
2916. John Barton, Stockport—Improvements in shuttles or shuttle tongues.

Recorded December 26.

2918. Alexandre Tolhausen, 7 Duke-street, Adelphi—Certain improvements in railway axle-boxes.—(Communication.)
2920. John W. Lewis, Manchester—An improved picker for looms.
2922. Sylvanus Sawyer, Massachusetts, U.S.—An improved bomb shell.
2924. David M'Cullum, 3 Victoria-place, Stonehouse, Devonshire—Improvements in electric telegraphs.

Recorded December 27.

2926. Simon Petit, Versailles, France—A new or improved apparatus for buoying ships or vessels, and also drawing them out of water.
2928. Alfred Krupp, Essen, Prussia—Certain improvements in guns and gun carriages.
2930. Edwin Ladmore, Birmingham—A new or improved method of securing ramrods to military fire-arms.
2932. John Grist, Islington—Improvements in machinery for the manufacture of staves and parts of casks, and for forming them into casks, barrels, and other like vessels.

Recorded December 28.

2934. John Robinson, Richard Cunliffe, and Joseph A. Collet, Manchester—Improvements in locomotive steam-engines, and in springs for locomotive steam-engines and other purposes.
2936. Thomas F. Uttley, Mytholm Royd, Yorkshire—Improvements in the mode of applying fusible plugs to steam boilers.
2938. George Chisholm, St. John's-square, Clerkenwell—Improvements in the manufacture of artificial manure.
2940. Henry G. Baily, Vicarage, Swindon, Wiltshire—Improvements in machinery for digging and forking land.

Recorded December 29.

2942. Lewis Harrop, Samuel Barlow, and Alexander Boyd, Oldham—Certain improvements in self-acting mules for spinning and doubling cotton and other fibrous materials.
2944. Alfred Ford, Park Lodge, New-road, Hammersmith—Invention for preparing and dissolving in naphtha or oil of turpentine vulcanised india-rubber, for the purpose of waterproofing, and all or any of the other purposes for which the same, not so prepared and dissolved, is now applicable.
2946. William Lange, 56 Tachbrook-street—Improvements in biscuit ovens.—(Communication from John Lange, Altona, near Hamburgh.)
2948. George R. Birch, Paddington—Invention of a form and folding desk combined, adapted for the use of schools.
2950. Thomas Holmes, Hull—An improvement in the manufacture of driving straps or bands for machinery.

Recorded December 31.

2954. Joseph Salter, Manchester—Improvements in apparatus for promoting the draught in chimneys, and for ventilating apartments.
2956. Archibald Turner, Leicester—Improvements in the manufacture of looped fabrics.
2958. George H. Cottam, St. Pancras Iron Works, Old St. Pancras-road—Improvements in applying detonating or exploding signals on the rails of railways.

Recorded January 1, 1856.

2. Ferdinand Swift, Brompton-row, Brompton—Improvements in carriage wheels and axles, and in vehicles for common roads.
4. Alfred V. Newton, 66 Chancery-lane—Invention of a novel system of propulsion, applicable to land and water.—(Communication from François Garnier, Clermont Ferrand, France.)
6. Alexander Cochrane, 11 Eaton-terrace, St. John's-wood—Improvements in collecting and distributing water and alluvial deposits contained in sewage and other water.

Recorded January 2.

10. Richard A. Tilghman, Philadelphia, U.S.—Improvements in the manufacture of iron.
12. Harvey L. Sellars and John L. Talbott, Cincinnati, Ohio, U.S.—Improved apparatus for measuring and weighing grain, seeds, and other substances.—(Communication.)

Recorded January 3.

14. Frederick Haines, 22 Lime-street, City—Invention for the deadening of the sound and the prevention of vibration and concussion in connection with machinery, gun and mortar boats, and general ordnance, and other purposes.
16. George Williams, 16 Cannon-street East—Improvements in the construction of water-closets for ships.
18. William A. Distin, 31 Cranbourne-street, Leicester-square—Improvements in pipes for smoking.
22. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in apparatus or means for facilitating the performance of church and other music on organs, harmoniums, pianos, and other similar keyed musical instruments.—(Communication from François Guichené.)
24. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in breech-loading fire-arms.—(Communication from Charles A. Friedrich, Stettin, Switzerland.)
26. James F. Lackersteen, 7 Young-street, Kensington-square—Improvements in the prevention of collisions on railways.
28. Charles Marsden, Kingsland-road—Improvements in the ventilation of sewers, tunnels, mines, and other confined places.

Recorded January 4.

30. Henry Bach, Sheffield—Improvements in the application of glass to decorative purposes.
32. William Simmons, Oldham—An improved hat body.
34. Thomas Hudson, South Shields—An improvement in furnaces.
36. Edward H. Bentall, Heybridge, Essex—Improved machinery for pulping turnips and other vegetable matters.
38. George T. Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in the manufacture of jacquard, piled, or terry fabrics, when particoloured yarns are used.—(Communication.)
40. Francis W. Gerish, East-road, City-road—An improvement in the manufacture of cast hinges.
42. William O. Johnston, Broomfield Colliery, Acklington, Northumberland—An improvement in apparatus used for giving notice when the water in a steam-boiler is too low.
44. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of iron and steel.

Recorded January 5.

46. James Coxeter, 22 Grafton-street East, St. Pancras—An improvement in an apparatus for generating steam for medical and other purposes.
48. Joseph Corbett, Brierly Hill, Staffordshire—A new or improved method of preserving the tuyeres of blast furnaces.
50. Conrad A. Hanson and John Wormald, Belmont, Vauxhall—Improvements in signal and other lamps.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

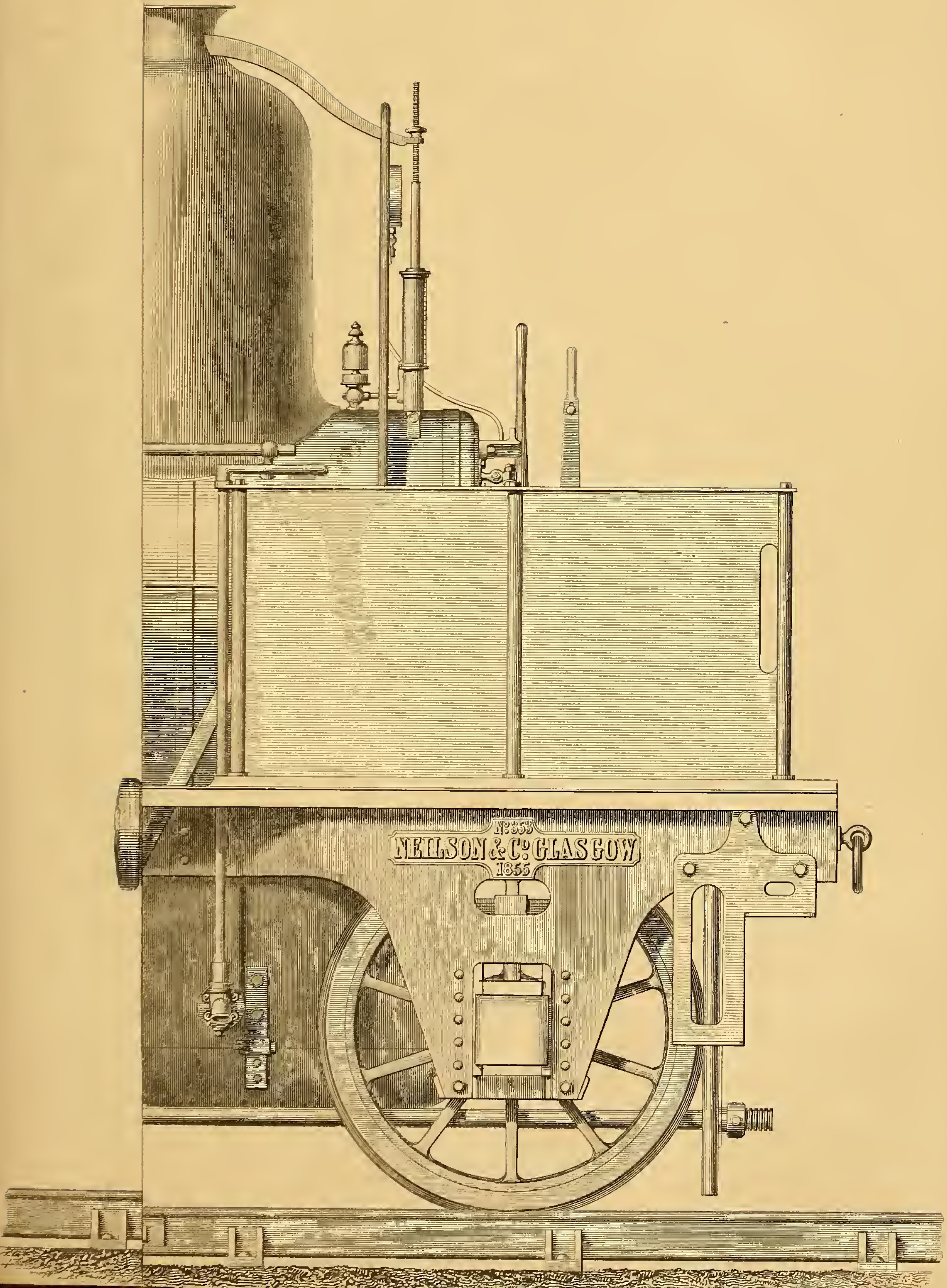
TO READERS AND CORRESPONDENTS.

Completion of the Eighth Volume of the Practical Mechanic's Journal.—Our next Part, No. 96, completes the 8th volume of this *Journal*, when the entire set of volumes may be had from any bookseller, in cloth, lettered in gold, price 14s. each; or the whole 96 Parts may be purchased, as originally published, at 1s. each. The first six volumes may also be had, handsomely bound in half calf, in three double volumes, with the Plates bound separately to correspond. Price 31s. 6d. for each double volume and volume of Plates. Vol. 8 will contain 27 quarto pages of Copperplate Engravings and 500 Engravings on Wood, with 296 pages of Letterpress.

A Subscriber.—Sinclair's hydraulic engine is engraved and described at page 115, Vol. VI., *P. M. Journal.* We do not think that working drawings of the other invention are obtainable.

T. T. W. S.—There are various works of the kind. A short examination of the back Parts of this Journal will show that we have reviewed many such books. Besides this, our "Mechanic's Library" gives the title of everything of the kind as issued.

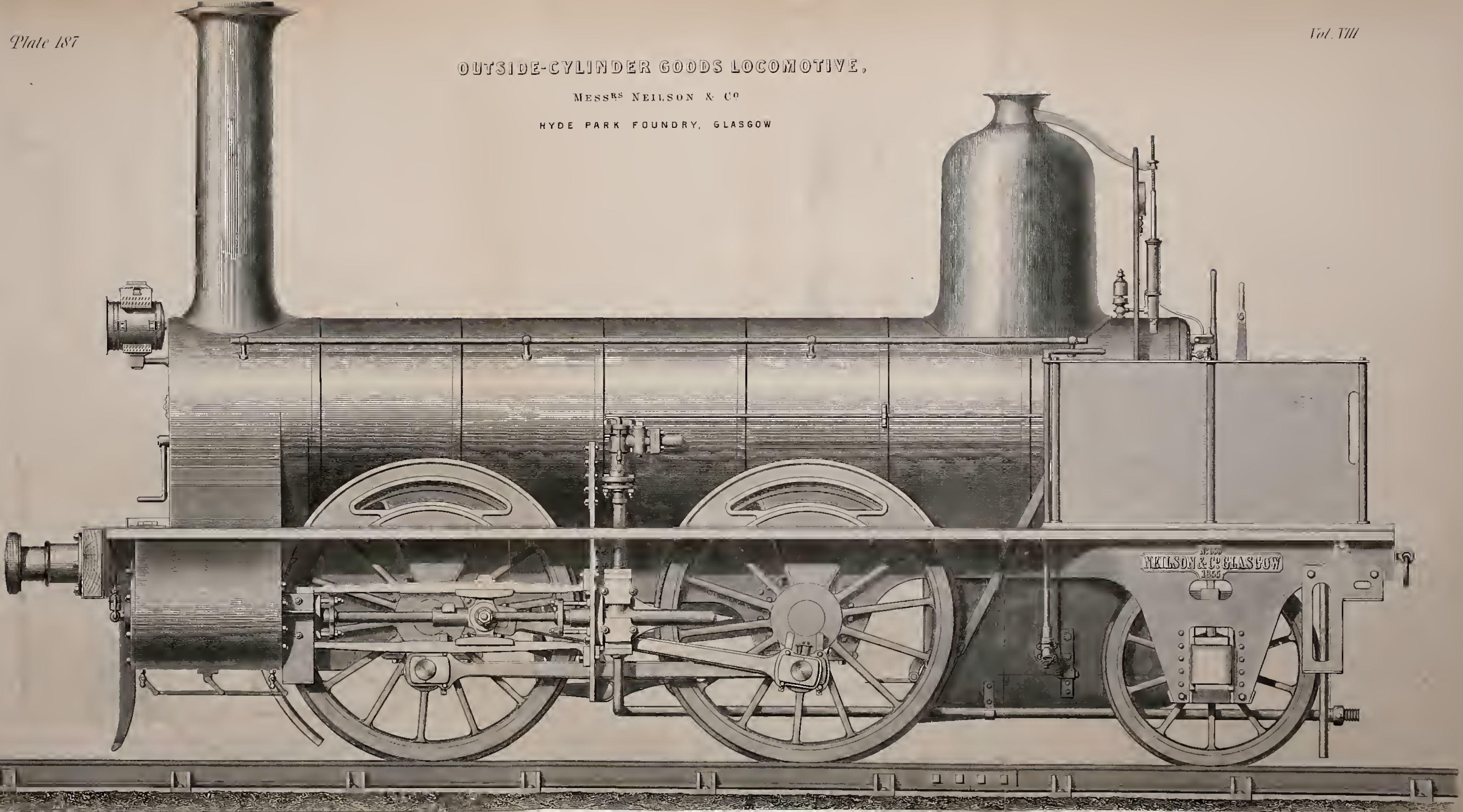
G. E. B.—We cannot undertake to recommend "best books." See "Noad's Lectures on Electricity and Galvanism," 16s.; "Encyclopædia Britannica," 8th edition; "Faraday's Researches;" and Lardner's "Electric Telegraph Popularised," 2s.


No 353
NEILSON & Co GLASGOW
1855

OUTSIDE-CYLINDER GOODS LOCOMOTIVE,

MESSRS NEILSON & Co

HYDE PARK FOUNDRY, GLASGOW



OUTSIDE-CYLINDER GOODS LOCOMOTIVE ENGINE.

By Messrs. Neilson & Co., Hyde Park Foundry, Glasgow.

(*Illustrated by Plate* 187.)

> "The art by which the products of labour and thought, and those who labour and think, are transferred from place to place, is, more than any other, essential to social advancement; without it, no other art can progress."—Lardner.

Year by year, as the railway system has become developed and solidified, the locomotive, and its railed path, have been subjected to demands of constantly increasing severity. A passenger train takes, it may be almost said, its thousands of passengers, at a rate which, compared to all other modes of progression, is as the flight of a bird. The goods engine, if it runs somewhat slower, yet transports a very mountain of matter, which, as a single load, would, a few years ago, have been fabulous indeed.

The railway has made all the difference between the wilderness and the smiling corn-field, for it has found the farmer a market for his produce, and made it worth his while to reclaim the previously inaccessible morass and mountain-side, and subjugate the barren fallow to the dominion of the plough. The tiller of the soil must have cheap and good conveyance communication, or his crop and stock must remain where they are raised, and the operations of the farm will languish for want of more intimate connection with the external world. The productions of the farm laboratory and factory are pre-eminently bulky and heavy, in comparison with their intrinsic value, and they can only be rendered profitably available by the agency of a cheap and untiringly powerful and comprehensive system of transport. This can alone be afforded by the railway and the goods locomotive, and its sister power, the coasting steamer. Similarly, the operations of the merchant and manufacturer are governed and regulated in a high degree by the resistless steam carrier, and the presence or absence of a railway largely affects not merely the well-being, but the very existence, of important manufacturing centres.

Go where we will, do what we will, we feel the benefits which the mechanical engineer has given to the world in this giant power of moving from place to place, with marvellous celerity and certainty, and, it may be unhesitatingly added, with economy. The engineer, with steam, as it were, in his hands, wields a conjuring instrument of uncontrollable might; and in no direction is this more manifest than in that of mechanical conveyance, which has successively swallowed up the road waggon, the canal boat, and the fast mail coach. The working machinery to which it has given rise, claims for itself a special, and by no means inconsiderable, chapter in mechanical history—a history to which we even now contribute a prominent paragraph, in the form of a series of three elaborate plates of an improved arrangement of locomotive engine, as made by Messrs. Neilson & Co., of Hyde Park Foundry, Glasgow.

The general contour and appearance of this engine may be gathered from the external elevation which we now give; but the essential details of the parts to which the inventor has more especially devoted his attention, must fall to be explained by the succeeding plates, embodying three other views more or less explanatory of the internal construction of the engine.

The modifications which Mr. Neilson, of the above firm, has thus successfully worked out, are capable of application in many varieties of engine; but the form under which they have been here worked out, is that of a six-wheeled coupled goods engine. The continuous and severe vibrations, strains, and concussions, which all locomotive engines meet with in their headlong career, tell serious tales in the repairing shops, and the books of the shareholders. All the ingenuity of locomotive engineers is continuously directed to the mitigation of the evils of wear and tear, and the most costly expedients are daily resorted to for the removal of imperfections which active service develops even in the most carefully considered designs, and the best examples of work. So nice a machine as a modern locomotive, with its array of boiler, furnace, tubes, cylinders, and valves, which must all work in beautiful concert, or not at all, cannot long resist the rough usage involved in its rapid transit, with heavy loads, over comparatively uneven ways. It is a machine full of complex refinements, and yet expected to undergo the hardest labour. The practical result is not seen by the traveller, who is hurried along a line of railway at a rate which leaves nothing to wish for, by a well-appointed engine. But let him visit the "hospital," or repairing shop, of the line, and he will read an important lesson on the certain failure and deterioration which await all highly-worked mechanical contrivances. He will find that, after a very few years, each locomotive requires such extensive repairs, that there must always be a very considerable proportion of the locomotive plant laid up perfectly unserviceable. Hence it is that a certain proportion of the rolling stock may always be taken as a constant amount of capital laid up and totally inactive, with an equally constant addition to the amount locked up, in the shape of the repairer's wages, and the numerous other items of expense which are necessarily involved. It is certainly obvious that there are many circumstances bearing upon the relative amount of the expenditure on this account, to which all railway companies must submit; but it must occur to every one, that in the strength and good quality of the materials, and the honesty of the workmanship of the machine itself, the greatest safeguard against such expenses must depend.

Besides this, the simplicity of the construction, and the accessibility of the parts, very greatly reduce this outlay, as must be evident from the time saved in effecting repairs. Every day saved in the time of repairs is not only a saving in the actual outlay, but a saving in the actual accumulated strength of the whole railway plant. This is easy of illustration, for if, by any means, the average number of engines in the repairing shop could be reduced by three, such reduction would in reality be equal to the addition of a constant quantity of three engines to the working stock which is kept up in all its integrity.

The outside cylinder engine clearly seems to be gaining favour against its competitors. Mainly on account of its economical advantages in this way, and with this view of the subject, we now illustrate our remarks with the best example of this class, as a goods engine, which has come under our notice.

In examining this engine in detail, we find that, in the first essential place, the entire engine is built and completed wholly independently of the boiler, and the latter is so arranged that it can be at any time easily detached and taken from the working mechanism. The form of the framing, and the fixing of the cylinders to it, afford a simple but most secure arrangement, and the general disposition of the whole of the parts is obviously the best that could be obtained for securing effective weight upon the driving wheels.

The parallel boiler is very simple in construction, whilst it is stronger, more durable, and more easily repaired, than when formed with the raised external fire-box and the smoke-box. The steam room lost in this arrangement, is compensated for by adopting a large steam dome.

The trailing or hind wheels have outside bearings, and each driving wheel is balanced. The steam cylinders are 16 inches in diameter, with a stroke of 22 inches. The four driving wheels are 5 feet in diameter, and the running wheels 3 feet 6 inches.

The external appearance of this engine is peculiarly prepossessing. It gives the idea of good balance, and the parallelism of the boiler, with nothing to break the smoothness of its upper line but the chimney and the steam dome at the two ends, produces a severely handsome effect. But we shall not anticipate the details promised in our succeeding views, further than by saying, that the engine from which our drawings were made is in full and satisfactory work on the Edinburgh and Glasgow, and Caledonian Railways.

MARINE PROPULSION, OR THE INFLUENCE OF "FORM" IN PROPELLING BLADES.

Our earlier readers will remember the appearance in our pages of a series of valuable articles "On the paddles of steamers—their figure, dip, thickness, and number;" and "On the propulsion of steamers," by Mr. Ewbank of New York. The first of these contributions was given at pages 104 and 124, vol. 2, and the second at pages 221, 245, and 270, vol. 3; and page 9, vol. 4 of this *Journal*. The reproduction here of the present paper by the same author, will need no other introduction than this reference.

An increase of speed in ocean steamers is of acknowledged importance to the commercial and social interests of the world. Is it attainable? Yes; for no truth is more certain, though it may not be perceived, or but dimly perceived, that every acquisition in the arts is a step in the order of progression, that serves, or ought to serve, as a fresh starting point to enable us to keep rising in mechanical knowledge and in its applications. How, then, is it to be achieved? Not by blind experiments, which have been tried long enough. In common with the lower tribes, we can meet exigencies in the arts with instinctive devices, and continue to meet others by the suggestions of experience; but there is a limit to empiricism, and then, in order to advance, an appeal to principles becomes necessary, because new bases of operation are wanted, which are not obvious to sense, and which nothing but an investigation of principles can disclose. To some extent this is, I think, applicable to steamers. There is an element in the propulsion of vessels that has hitherto been overlooked, and upon it, I believe, the next step in advance must be based.

I wish to urge the value of *form* in propelling blades, for I am sure that in it is to be realized the desideratum of speed. A correct outline is everything in those instruments, because every desirable quality *flows from it*—qualities which it is impossible to realize with the old rectangular planks in common use. I question if a grosser example of neglect of form than these present can be named, or where the consequences have been so serious—examples of greater looseness about principles and greater persistence in malpractice. Among the higher or even lower classes of machinery, few such deviations from rectitude can be found, and fewer still that have been so long borne with. But it has happened to them as to other characters whose proclivities to wrong-doing are innate—they have been endured till a sense of their deformities has vanished.

Though we may bungle along with misshapen blades, we cannot elude the penalties attached to them—as great waste of power, unnatural wear and tear, constant straining of the vessel, no marked increase of speed, and a premature breaking up of the whole. Of this severe punishment for neglect of form, the history of steamers is replete; but, unfortunately, offenders are insensible to the offence, and to what it costs them. This is not, however, the case in all things; and hence, while steamships still spend much of their costly power for nought—while their wheels continue uselessly to thrash the water and heave up tons over them—while their machinery is jarred, and their massive shafting now and then wrenched apart by excessive strainings, the hulls are not kept in such violent and ceaseless paralytic trembling as formerly. Modern vessels outstrip former ones, because their outlines have been improved; and when equal efforts are made to improve those of propelling blades, steamers will begin to be what they ought to be.

Admitting that much is to be done in the construction of vessels and in motive machinery, their rate of going must continue to depend on their propelling apparatus. While it is defective, fleetness is unattainable, though all things else were perfect. The finest formed flyers move heavily with crippled wings, and we can have no swift skimmers of the seas with deformed organs of motion. Believing, as I do, that success is to be found in the true form of propelling blades, the following observations are submitted to marine engineers. Should they conclude that there is nothing in them, nor in the simple proposition itself, I would ask in what direction do *they* expect to succeed? On what other parts of a steamer do they propose to operate? On the hull, the boiler, the engine, or the wheels? On the number, width, depth, and dip of the buckets, &c.? Surely, on these points nothing decidedly new or promising can be expected, much less the development of *new elements* of propulsion; for, after all, that is what is wanted. The squeezing out, by extraordinary exertions, of a few more feet or rods to the hour will not satisfy the present age, let alone future ages. It would only show that the virtue of the present paddle is exhausted; that nothing, or next to nothing, more is to be got out of it.

But are new elements of speed to be elicited from the mere shape or outlines of the blade? Yes. But paddle-blades have long been experimented on, and the result has led to the universal preference of the original rectangular slabs, and to the recognition of the primitive wheel as "the prince of propelling devices for speed." True, and the fact is conclusive that the existence of virtue in the *form* of the buckets is not suspected. It is not sought for, and consequently not found. Planks were the readiest forms and materials at hand in the beginning, and were with little reflection adopted, just as they have been continued. It is demonstrable that the highest attainable speed is impossible with paddle-planks, utterly impossible, and that it can only be attained in connection with other engineering desiderata; such as the least waste of power, the least amount of material in the blades, the diffusion of the resistance over their entire surfaces, every section producing equal effects though very unequal in area, the centre of resistance not at the extremity but in the centre of the blade, and thereby putting the least strain upon the arms or levers. When these properties, and the utmost *thinness* in blades, their smooth working, freedom from liability to sudden or increased strains are acquired, the true form will have been obtained, and, what may appear problematical to many, they will be found to have proceeded from it—illustrating a cardinal truth in physics, that in proportion as a device approaches the truth in form, it approaches it in every other particular.

It is, however, a melancholy fact, that there is among our engineers a prevailing indifference to, and unbelief in the value of form, which can only be ascribed to their not having looked into the subject. They do not perceive how two blades of equal areas, but differing in their outlines, should possess different properties; surface, not boundaries, being what they rely on.

That there is an innate relationship between cause and effect, and that the latter is modified by the instruments through which the former acts, is obvious to everybody. A blunt, that is, a badly-formed tool, consumes more power than a sharp one, and gives inferior results; so it is with everything through which force is conveyed. Mechanical science rests upon principles that determine forms and proportions. *There is, of necessity, a best form for everything and for every purpose.*

What, then, is the form of propelling blades which communicates properties not found in common ones? In general terms, it is that which is exemplified in Nature's blades. The law that determines them makes them *long*, *narrow*, *tapered*, and *pointed*, and contracts and expands these features as speed is to be diminished or increased. The form and application are antipodal to rectangular buckets, because the blade must taper as it dips; the deeper it enters the water, the narrower it must become.

The effects of this simple change of form are as surprising as they are important. The most essential attributes of a propeller are evolved:—

1. *The least amount of material in the blades.* They are not made uniform in thickness, but are thinned away towards their extremities, a feature incompatible with rectangular blades.

As the reduction of thickness of natural blades outwards is a permanent feature under all circumstances, it might have been inferred from that fact, that the same trait might be indispensable to success in artificial propulsion. It has not been so inferred; and we are, therefore, led at once to inquire why natural blades are reduced outwards, and to a mere film? Because length of stroke virtually *diminishes with thickness*, and *a waste of power keeps pace with it.* This is demonstrated in our paddle-wheels. If a pair of these were made in the form of close drums or solid cylinders, they could, of course, have no propelling power whatever; no more than have grindstones revolving in their troughs. Suppose half of each removed, and the usual number of arms and buckets or blades put in their places, the wheels, as they might then be called, could have only half the usual power; and if one-third, one-fifth, or any other proportion of the cylinder were left, in the same proportion would their capacity for propulsion be neutralized. It is, therefore, an inexpugnable truth, that whatever may be the number of blades in a wheel, the sum of their thickness must be deducted in every revolution from their sweep through the water, in order to determine their propelling capacity, or the work they should perform. In the supposed case of half the wheels being solid, the semi-cylindrical masses were simply distorted blades.

Taking the mean thickness and number of the massive planks that constitute the blades of ocean steamers, they lose from this cause from eight to ten feet of stroke in every turn of each wheel. Assuming two hundred and fifty thousand revolutions as the average number in a trip across the Atlantic, over five hundred miles of stroke are thus lost in each wheel; or, in other words, between twenty and thirty thousand pounds of timber are whirled that distance through air and water, and to no purpose but consuming power and wearing out the motive machinery. We may commit all manner of delinquencies in construction, but we cannot harmonize a philosophical truth with an opposite error. *Thinness* of blades and the *least material* in them, and the consequent least expenditure of power, depend upon form. There is no separating them. Instead of being tapered away toward their extremities as in natural instruments, ordinary blades are made as blunt there as anywhere else. They are, in fact, often made thicker by bolting on additional slats, and they require this, since the resistance is accumulated there.

2. In the *reduction of the number of blades.* The adoption of tapered ones would enable us to throw overboard two-thirds or three-fourths of the number now used, with the same proportion of shafting, as not simply useless, but positively injurious. This cannot be done with the present blades, on account of the jarring caused by their violently slapping the water as they come down upon it. When few blades are used, the effects of this are seriously destructive; and hence, to reduce the concussion, the number is increased, on the principle of dividing a few large blows into many little ones. Some boats have had seventy-two blades on each wheel; many have now thirty-six. Thus one error called in another, for it was not perceived that as their number was multiplied their efficacy was diminished.

A correct form would have removed the evil at once, and the cause of it. Instead of a propelling surface, extending from twelve to fifteen feet from a vessel's side, being brought in sudden conflict with a wave, a mere point of the blade would have been presented to it. Instead of attempting to arrest the swell, and be shaken or carried away by it, it would go softly and silently into and through it.

3. In *removing the centre of pressure* from near the extremity *to the centre of the blade*, and in an *equable distribution of pressure over its face.* It is the characteristic of a good and durable instrument, that its material is so distributed that every part contributes its due proportion of influence towards the intended result, *and no more.* No other criterion than this is required to determine degrees of worth or worthlessness. How is it with rectangular blades? Why, in truth, it must be admitted, that in this respect they are defective, and to a degree which, I suspect, can hardly be paralleled in modern mechanism. Their lower parts, sweeping through greater spaces in the same time than those above them, do most of the work, nearly all of it, and thus destroy the equilibrium of pressure on the face of a blade, which, *above all things* else, should be secured, and introduce an element of destruction that reaches from them to everything connected with them. One-third of a steamer's blades have been removed from their upper parts without diminishing in the least her speed; a result that might safely be predicted of some boats now running.

An equable distribution or equilibrium of pressure on a surface whose several sections are immersed at unequal depths, and moved with unequal velocities, might seem impossible on a first thought; but a second one would suggest that there must be, *per se*, some provision of the kind for this class of movements, as there are for others, and that, too, by varying the outlines of the surface without enlarging it—a principle equivalent to that exemplified in the lever by simply moving the fulcrum; and in fluids to that by which a pint of water may be made to balance a gallon or a thousand gallons; THE principle, in fact, which raises or lowers the centre of pressure on a blade, not by adding anything to it, but by merely widening or narrowing it—*which modifies velocity by surface, and surface by velocity*, so that every portion meets only its proper amount of resistance, and all portions harmonize in bringing out one result.

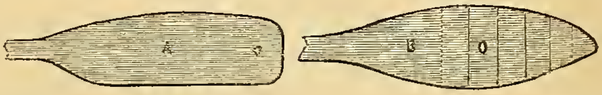
4. Another beautiful result is, that though the blades may taper to a point, a section near that point does just as much work as an equal section through the widest part—extended sweep compensating for diminished surface.

Such are some of the results of form in propelling blades, and they are what are now wanted to enable us to begin a new career in ocean steamers.

Variously-shaped blades have been tried on the stern submerged propeller, but for them no definite form has been developed. Most of them are as wide of the truth as the planks of side-wheels. The resistance is accumulated at their extremities; the largest extent of surface is there, and, consequently, the greatest strain upon the levers or arms and shafts. The true form, whether worked at the side or stern of a vessel, is only to be determined by the properties named, and, as already remarked, they are applicable to every propeller. The law makes no discrimination in favour of one application over another.

The blades of *oars* partake of the same defect as those of steamers' wheels, though in a less degree, because of their being applied in the direction of their length, instead of being attached across the ends of their levers. Uniform in width, the parts farthest from the centre of motion move with greater velocity than the rest, and hence it is the end of an oar that does most of the work: portions in the rear move slower than it—they are *behind* it in their action, and cannot, therefore, sympathise or coalesce with it. In some oars the ends of the blades are wider than the other parts, when the defect is still greater.

To enable an oar blade to return an equivalent for the power transmitted, it should diminish in width from near the middle of its length, and in such a ratio that every part may perform an equal proportion of work, and in *unison* with every other part. In the common blade, A, the centre of resistance from the water is near O; but let *the same amount of surface* be formed like B, and the centre of resistance would be at the same distance from the centre of motion, while the end of the blade would be thrown further out, and greater effects obtained by the same power. Every section, from the middle of the blade to the pointed extremity, would then be equally effective, though so unequal in area, because its surface, multiplied by its velocity, would give the same resultant as every other section. In such a blade, no part could embarrass the perfect action of any other part. All would be in accord.



The object of the foregoing remarks is to awaken attention to a problem in practical science, than which there are few of greater and none of more immediate value.

It is greatly to be desired that the government would institute, through a commission, a series of experiments to determine the true forms and proportions of propelling blades. The report would be of permanent and world-wide interest.

SLATER AND TALL'S WOOD-WORKING MACHINERY.

Fig. 1.

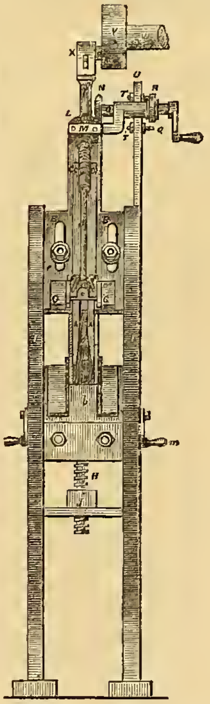
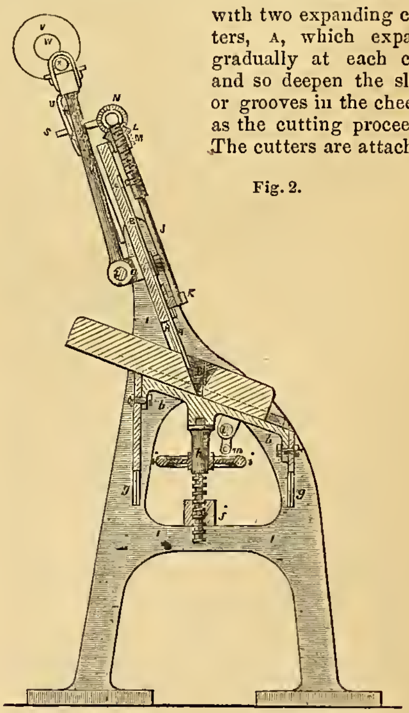


Fig. 2.



We have already* made our readers acquainted with some of these ingeniously devised machines for working in wood, and more particularly for cutting and shaping the wooden portions of planes and other tools, invented and perfected by Messrs. Slater and Tall. On the present occasion we have engraved views of a mortising machine, especially adapted for cutting out the grooves in the cheeks of the plane's cavity. Fig. 1 is a front elevation, and fig. 2 is a vertical section of the machine. This machine is fitted with two expanding cutters, A, which expand gradually at each cut, and so deepen the slots or grooves in the cheeks as the cutting proceeds. The cutters are attached to the slide, B, by small screws, C, on which they work as fixed centres. One of these cutters is represented in front elevation and section in fig. 3, and the peculiar form of its cutting edge is shown by the diagram plan at the lower part of the figure. Small stud-pins, D, are fitted into the cutters near their lower extremities, and work in two slots, E, in the small plate, F, the slots being inclined towards each other at their upper extremities. The slotted plate or expander, F, bears upon the upper face of the cutters, and is retained in position by two guide pieces, G. These guides are screwed to the face of the slide, B, which works in oblique V-grooves at H, formed in the cheeks of the side standards, I. A spindle, J, screwed at its upper extremity, is fitted at its lower end into a projecting lug, K, on the expander. The screwed portion of this spindle, which serves to actuate the expander, works through the boss of the bevil-wheel, L, which has an internal thread formed in it for that purpose, and this boss turns freely in the short bracket, M, screwed to the top of the slide, B. The bevil-wheel, L, is actuated by the corresponding wheel, N, which is fast on one end of the short spindle, O. This spindle works in a collar-bearing, P, cast in one piece with the bracket, M, and carries a ratchet-wheel, Q, which is actuated at each ascent of the cutters by the pall, R, jointed to the lever-arm, S, this lever-arm being forked, and working loosely on the spindle, O, on each side of the ratchet-wheel. This lever projects behind the machine, and as it rises and falls with the slide, B, with which it is connected, it comes in contact with one or other of the studs, T, T′, which are fixed in a slot in the vertical bracket, U, bolted to the back of one of the side standards. The slide, B, is caused to rise and fall by means of a disc or eccentric, V, keyed upon one end of the main driving shaft, W, such disc having a stud-pin, X, fixed therein for the attachment of the upper end of the connecting-rod, Y, which is secured, at its lower extremity, to a transverse spindle, Z, carried between the lugs, *a*, fitted or cast upon the back of the slide, B. On the rotation of the disc, V, the slide, n, with the cutters, A, and the whole of the expanding mechanism, will have an alternate upward and downward motion communicated to them; and when the tail of the lever, S, in its upward movement, comes in contact with the upper fixed stud, T, it will be depressed slightly, and will consequently draw over the curved pall, R, and turn the ratchet-wheel, Q, and spindle, O, to a certain extent, according to the amount of depression of the lever, S, its movement being adjusted or regulated to any required extent by raising or lowering the stud, T, in its slot. This partial turn of the spindle, O, turns also the bevil-wheel, L, through the wheel, N, and, consequently, slightly elevates the spindle, J, and expander, F, which, by reason of the inclination of the slots, E, acting upon the pins, D, in the cutters, causes them to expand. This expansion of the cutters will, therefore, take place at each up-stroke of the machine, so that, on the succeeding descent of the cutters, they will each take a fresh shaving off the cheeks of the plane. This action proceeds until the proper depth of groove is attained, when the expanding mechanism is thrown out of gear, and the plane is set up slightly on the adjustable inclined table or bed, *b*, causing the already formed groove or slot to be widened at each descent of the cutters, the peculiar form of cutting edge thereof serving to clear out the wood at right angles; that is, the cutting edge, *c*, of the tool will tend to widen the slot at each descent of the cutters, whilst the cutting edge, *d*, will clear it from the cheek. In widening the slot or groove, the third cutting edge, *e*, will not, of course, be in action, that is, it will have no material to operate upon. The three cutting edges, *c*, *d*, and *e*, however, will all effect a cut when first commencing the slot or groove, the edge, *d*, tending constantly to deepen the slot, whilst the edges, *c* and *e*, will clear out the wood at the sides of the same. As the slot or groove to be cut is not parallel, however, but tapered, in order to receive the wedge, it is necessary to elevate or wedge up the lower end of the plane, and this wedging is gradually increased until the cutters descend in the direction of the inclined edge, *f*, of the slot, when the operation of grooving will be completed. The supporting bed or table, *b*, may be adjusted vertically in the V-grooves, *g*, formed in the inner sides of the main standards, by the vertical screw-spindle, *h*, and hand-wheel, *i*, the upper end of the screw working loose in a boss cast on the under side of the table, whilst the screwed portion of the spindle works through a fixed nut, *j*, bolted to the framing. The plane to be operated upon is placed on the table, *b*, and is grasped between two adjustable bars, or jaws, which are held together and tightened upon the plane by screws, being kept parallel by guide pins working in slots formed in them.

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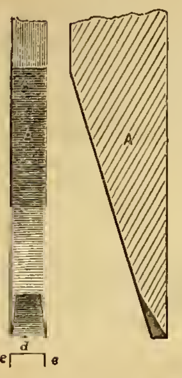
* Page 267, Vol. VII., *P. M. Journal.*

Fig. 3.

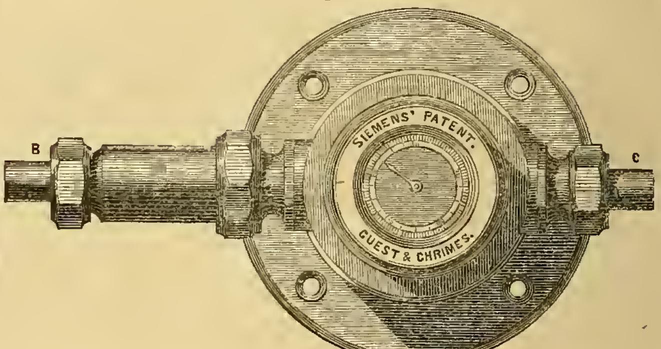


SIEMENS AND ADAMSON'S "BARKER'S MILL" WATER-METER.

The elegantly ingenious device of a rotatory water-meter on the screw principle,* to work under high fluid pressures, without robbing the original supplying head of any of its power, contrived some time ago by Mr. Siemens, has enjoyed an extensive practical test in such a way as to completely develop all that could be said for or against it. The result is, that this pretty piece of mechanism has failed, not, however, on the ground of faulty construction, or inaccuracy of measurement, but solely because it was found to be impossible to protect the delicate working parts, on which the truth of this water watchman depends, from the rude action of the water passing through it. But, nothing daunted by this unsuccessful venture, Mr. Siemens, in conjunction with Mr. Adamson, has gone to a new principle to gain his end, and has achieved a success which, so far, seems sound and permanent. This new principle is that of "Barker's mill," or the reaction wheel so much used latterly as a hydraulic motor, in substitution for the common forms of water-wheel.

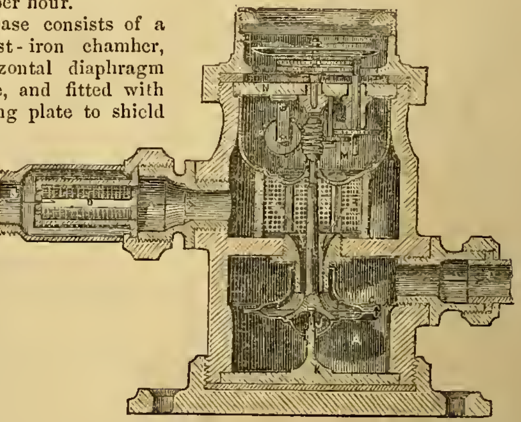
This adaptation of mechanism affects but slightly the head pressure of the water to be measured, and our illustrations attached, show that it possesses the important element of compactness in a remarkable degree. In our engravings, fig. 1 represents the meter one-third the real size, the view being taken on the indicating dial face, just as the instrument would appear to the observer in examining it *in situ*. Fig. 2 is a section of the meter corresponding; and fig. 3 is a perspective view of the mill-drum or rotating measuring case detached. This detail is engraved full size. A meter of this size is calculated to measure 300 gallons per hour. Fig. 4 is another perspective view, on a half size scale, of the drum of a meter capable of passing 4,800 gallons per hour.

Fig. 1.



The meter-case consists of a cylindrical cast-iron chamber, having a horizontal diaphragm near its centre, and fitted with a glass covering plate to shield the indicating mechanism. This chamber has two lateral branch pipes, B, C; the first for the admission of the water above the diaphragm to be measured, and the second for the exit of the measured water from below the diaphragm. On entering the meter, the water first passes through a filter, D, which is a perforated cylinder, contrived for the retention of dirt, and it thus reaches the body of the casing above the diaphragm. On this diaphragm is a second annular filter, E, through which the water is made to flow, to give it a second and more

Fig. 2.



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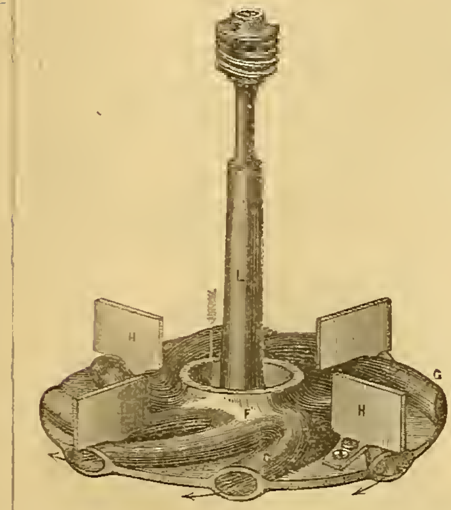
* See our Plate III., Vol. V., *P. M. Journal.*

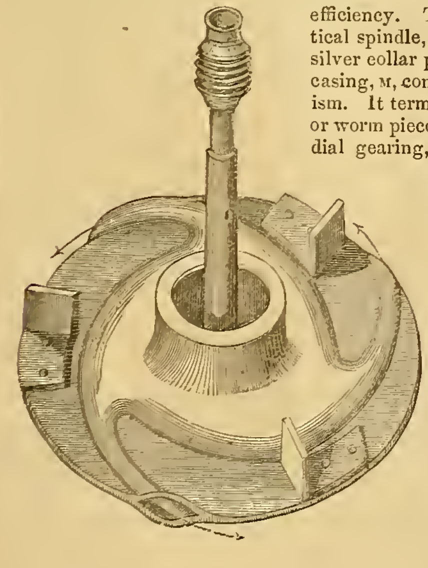
complete cleansing from foreign matter. In the centre of the diaphram, and directly beneath this second filter, a conducting tube is screwed in to convey the water down into the "Barker's mill" measuring drum, F. This conducting tube passes down through the open upper end of the vertical portion of the drum, there being no actual contact between the stationary tube and the rotating drum, as the two only come into close feather-edged proximity. This is important, inasmuch as any sedimentary matter held in suspension in the water cannot affect the working surfaces, owing to the shortness and nicety of the contact.

Fig. 3.



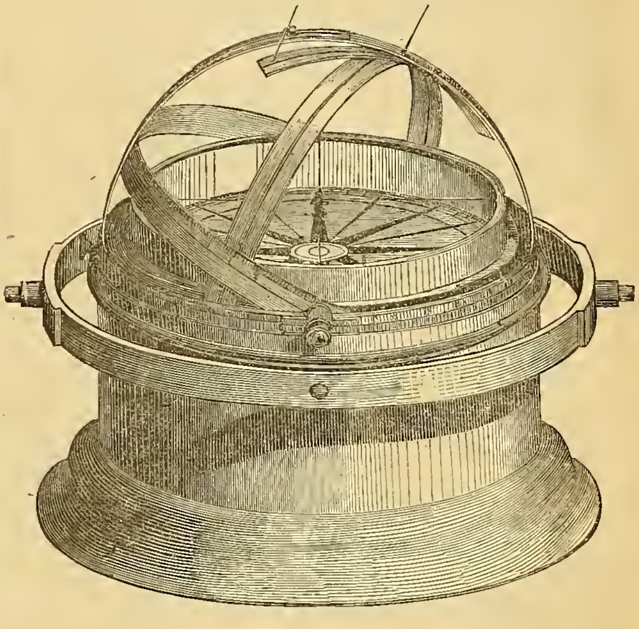
The drum has three reactionary discharge arms or ducts, G, as detailed more clearly in fig. 3. The effluent discharge from these passages is regulated, so as to give uniformity of measurement, by the adjusting vanes, H. The main section of the meter clearly indicates the sectional contour of the drum and its thoroughfares, as closely resembling the motive power wheels which have been so elaborately worked out in late years, from the original idea of Barker. The water flows through each of the arms, in the direction of the arrows; and the unbalanced or reactionary pressure causes the drum to revolve in the reverse direction, the quantity of water passed for each turn of the drum being constant. The water falls into the bottom part of the meter-case, and thence flows off to the service-pipe by the branch, C. The drum is supported upon a footstep of a peculiar form. An oil-cup, J, is attached to the bottom of the drum, and this cup encloses and lubricates the bottom brass spindle, K, standing up from the base of the meter-chamber; and at the upper end of the oil-cup there is a steel boss piece, resting upon a steel pin in the top of the spindle, K, on which pin the weight of the drum is carried. The whole of the working part is enclosed by the oil-cup, so as to preserve the surfaces in the highest state of efficiency. The drum has a long vertical spindle, L, supported by a german-silver collar piece, in the bottom of the casing, M, containing the index mechanism. It terminates in an endless screw or worm piece, for giving motion to the dial gearing, to indicate the measurement. This dial gearing is generally similar to that employed in Mr. Siemens' former meter. All of it, except the ingenious differential wheels, is in the space, M, which is covered in by the dial-plate, N. This plate is held down by screwing on the dial-cap at the top, with a ring of india-rubber to form a tight joint for the chamber, M, which is full of oil. The dial-cap is finally covered by a thick glass disc, through which the index can be seen from above. The larger drum, fig. 4, has eight water thoroughfares, with four adjusting vanes, the increase or diminution in the size of which affords the means of obtaining the greatest accuracy of measuring discharge.

Fig. 4.



Water has now become an article of great commercial value, and it is more than ever necessary that it should be paid for according to actual consumption, like everything else. Hence, every day brings us nearer to the time when a reliable water-meter, combining accuracy, preservation of the head pressure, simplicity, and cheapness, will be an admitted necessary in every man's house; and it becomes the duty of every one to consider how he may best accomplish such a result, by examining such apt contrivances as that which we now lay before the public eye.

THE MARINER'S COMPASS, AND THE CORRECTION OF ITS ERRORS.



"When from the bosom of the mine
The Magnet first to light was shown,
Fair Commerce hailed the gift divine,
And, smiling, claimed it for her own.
'This gem,' she said, 'my barque shall guide
Through tracks of ocean yet untried.'"

Since the appearance of our article on "The Magnetic Adjustment of Marine Compasses,"—devoted to the ingenious and efficient means adopted by Mr. Small in his "Marine Compass with Adjustable Corrective Magnets,"—the same inventor has gone still deeper into his subject, with the view of producing such an arrangement of the compass as should enable the ordinary sailor to find and correct the error, or needle deviation, in a purely mechanical and simple manner. The compass, fitted up according to his views, has taken the form represented in our perspective illustration annexed, representing the whole of the working apparatus as detached from the binnacle. The instrument for the determination of the error consists of these parts:—

A true meridian circle, graduated from 0 to 90 degrees, and marked "true meridian" on one side, and "latitude" on the other. An equatorial circle, on which is graduated the hours from noon or meridian, and marked on each side of the meridian circle "time from meridian." A moveable hour circle, which can be set to any hour angle by means of the equatorial one. This circle is slit along its centre, by which means each quadrant of it serves as a sight-vane for taking either celestial observations or bearings of terrestrial objects; it has also a plain segmental piece attached to it, for receiving the shadow of a style. A style, or pin, which is used for casting a shadow on the plain segmental part of the hour circle. These three circles and the segmental piece being fastened together, are attached to a horizontal circle, which is graduated all round to degrees, and marked from 0° to 90° on the right and left of the meridian. This is termed the dumb compass, and can be freely turned round in the compass bowl, or fixed in any direction by two pinching screws. The compass bowl is suspended horizontally in the usual manner. Two small magnets, which can be attached to the meridian line, to reduce the error if required.

The instrument is constructed upon the following principles:—Suppose the earth to be represented by a hollow transparent globe, with the hour circles marked upon it, and revolving upon an opaque axis; consequently, when one-half of any hour circle is directed to the sun, the shadow of the axis will fall on the opposite half of the same circle. The same object is attained by allowing a line of light to pass through the slit, along the centre of the hour circle of the instrument, instead of a shadow. The apparent time at ship and latitude being approximately known, and the latter being set by the latitude line, the former by the equatorial, and all turned in the compass bowl until the sun be seen through both slits in the hour circle; the true meridian is then determined, and the whole error of the compass shown, according as the needle is drawn to right or left of the true meridian; or the true direction of the ship's head is found in degrees by observing how far the true meridian is to the right or left of the fore and aft line, as marked on the compass bowl. The same result is found by using the style to cast a shadow on the hour circle.

If in north latitude, and the object south of the observer, the true meridian is turned towards the south, setting the latitude of the ship upon the circle marked latitude, and fixing it by the pinching screw. The hour circle is then set to time from noon, or meridian, to the right or left of the meridian circle, according as the object is east or west of the meridian. This done, all is turned round in the compass bowl until the object is seen through the slits in the hour circle. The observation is then complete; and, by observing how far the magnetic meridian is to the right or left of the true meridian, the error of the compass is at once seen—the difference between which and the variation, as on the chart, may be reckoned as local attraction. Or, by observing how far the true meridian is to the right or left of the fore and aft line, as marked on the compass bowl, the true course the ship is making is at once seen in degrees, to be reckoned from north or south towards east and west, as the case may be.

If the style be used, and the latitude and declination of the same name, proceedings are taken as before to set the latitude and hour circle to their respective places—then putting in the style at the top of the true meridian and hour circle; but if the latitude and declination be of different names, the style is put into a hole prepared for it on the plain segmental piece; in either case the shadow of the style will fall on the centre of the segmental piece of the hour circle. The style can only be used for the sun, the slits being used for moon, star, or planet.

In south latitude, and the object north of the observer, the true meridian will be placed towards the north, when observing. At all times, the true meridian should be turned to that point of the horizon where the observer would bring the object down to, if observing for an altitude.

The error being found, it may be reduced, if not wholly corrected, by two small correcting magnets, which are attached to the true meridian circle, and are at all times kept in a horizontal plane parallel to the compass card.

When the moon, star, or planet is to be observed, the meridian distance of the same must be found according to the "Rule in Norie," or other work on navigation.

These observations may be made either by the dumb compass or by a card to which a magnetized needle is fixed—in either case the same result is attained.

Mr. Small also furnishes a diagram to enable shipmasters to see at once the various changes which the ship's magnetism undergoes during a voyage, and it also provides for an approximate determination of the course to be steered by the deranged compass, so as to make a true magnetic one. Besides this, a "rectifier" is added for letting the shipmaster see his compass in its deranged condition, that he may know when he is steering on large or small points of it.

MECHANIC'S LIBRARY.

Algebra, Key to Elementary, 2nd edition, 12mo., 2s. 6d., cloth. Elliot.
Builder's Price-Book, 1856, crown 8vo., 4s., sewed. Taylor.
Chemistry, Elements of, Part II., Inorganic Chemistry, 16s. Miller.
Civil Engineering, (6th), 8vo., 18s., cloth. Mahan.
Engineers, Useful Information for, royal 8vo., 15s., cloth. Fairbairn.
Micographic Dictionary, illustrated, 8vo., £2. 5s. Griffith & Henfrey.
Ocular Spectres and Structures, 8vo., 5s., cloth. Jago.
Practical Mechanic's Journal, Vol. VIII., 4to., large plates and wood engravings, 14s. cloth. W. Johnson.
Rigger's Guide, foolscap 8vo., 7s., cloth. Bushell.
Science and Art, Year-Book of Facts in, 1855, 5s , cloth. Timbs.
Science, Wonders of, (2nd), 8vo. foolscap, 6s., cloth. Mayhew.
Warming and Ventilation of Buildings, 3rd edition, 3s. 6d. Richardson.

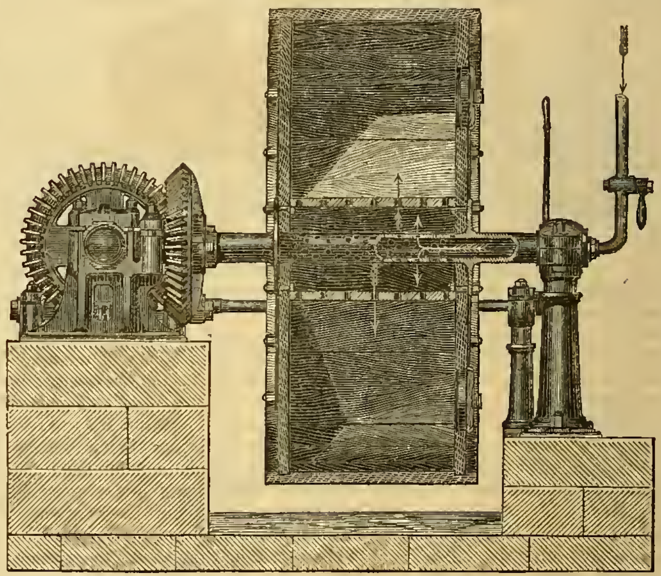
RECENT PATENTS.

DASH-WHEEL BLEACHING.

J. Wallace, Jun., *Glasgow.—Patent dated April* 25, 1855.

The object of these improvements is the rendering the ordinary dash-wheel more extensively available as a bleaching and cleansing agent for textile fabrics and materials, than has hitherto been the case. Our engraving is a transverse vertical section of apparatus, constructed according to one modification under which this invention is carried out in practice. The dash-wheel which, in its general features, is constructed like those hitherto in use, is mounted upon a hollow shaft, which is put in communication with a steam pipe by means of a suitable stuffing-box joint. Steam is thus supplied through the hollow shaft into the several compartments of the wheel, either through perforations in the shaft itself, or through openings in branch pipes connected to the shaft, such branch pipes being arranged in any convenient manner in the compartments.

The introduction of the steam alone into the dash-wheel is sufficient to improve greatly the ordinary bleaching, washing and cleansing, and "posting" effect of the wheel, but with the further introduction of acids, alkalies, soap, and other bleaching or preparing ingredients, the dash-wheel is made directly available as an excellent bleaching apparatus. Various classes of goods may be thus treated, but the invention is especially applicable for the treatment of sewed muslins or embroidered goods.



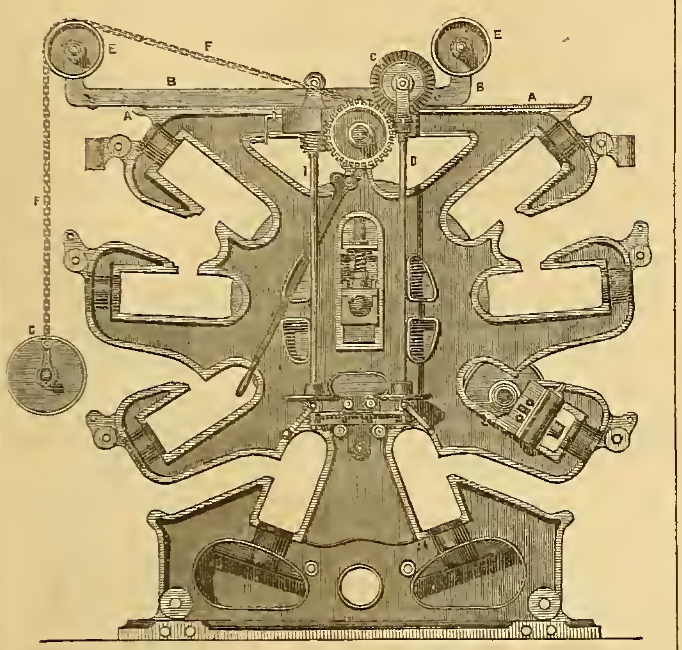
The articles to be bleached and operated upon by the dash-wheel are introduced into the compartments by the usual openings, and the bleaching ingredients being added, the wheel is put in motion, and the steam is let on through the tubular shaft, and the operation is completed in a much shorter time than is necessary according to the process hitherto in use.

It is obvious that various mechanical arrangements may be adopted in thus modifying and applying dash-wheels.

CALICO-PRINTING APPARATUS.

P. Smith, *Glasgow.—Patent dated February* 6, 1856.

This invention relates to the application to cylinder-printing machines of lifting and traversing apparatus, for facilitating the shipping or removal of the printing rollers. Our engraving is an end elevation of the framing of an eight-colour printing machine, showing the application thereto of the improved apparatus. Rails, A, are formed on the top edges of the framing standards, for the support and traversing action of a carriage or frame, B, fitted with pulleys to run on the rails, A. The side bars of the carriage, B, are formed with racks, into which gear pinions upon a horizontal shaft, C, crossing above the carriage, and serving at the same time to hold it down upon the rails. The traverse of the carriage is effected by means of the racks and pinions, the shaft, C, having a bevil



wheel on one end, in gear with a bevil pinion on the end of a vertical shaft, D. The lower end of the shaft, D, carries another bevil wheel, in gear with a bevil pinion upon a horizontal spindle, furnished with a handle for actuating it by. The carriage, B, carries pulleys, E, at its extreme outer edges, over which are passed chains, F, for suspending the printing roller, as at G. The chains, F, are wound upon barrels upon a horizontal shaft, H, upon one end of which is a worm wheel in gear with a worm on a vertical shaft, I, arranged for being driven by hand in the same manner as the shaft, D. When a printing roller is to be put into position on the machine, it is brought to the side thereof on a carriage, and the frame, B, being traversed over to that side, the chains, F, are lowered to take hold of the roller spindles. When the roller is raised sufficiently by winding the chains, F, the frame, B, is traversed inwards towards the machine, to convey the roller into its place, the two shafts, D and I, being worked together in such a manner as to guide the roller clear of the framing. By the adoption of this lifting and traversing apparatus, the arrangement and adjustment of the printing details is very much facilitated, and there is much less risk of injuring the printing rollers in moving them into or out of the machine, than when the common slovenly manual adjustment is practised.

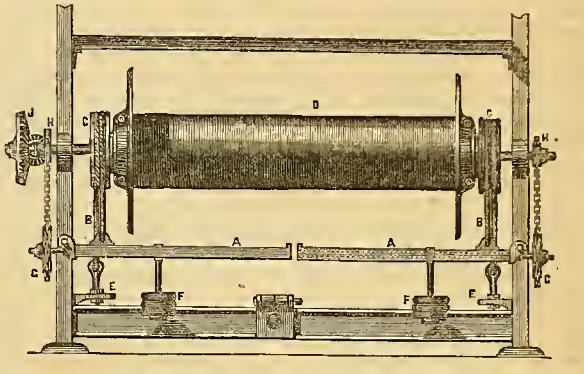
LOOMS.

C. Parker, *Dundee.—Patent dated June* 12, 1855.

This patent comprehends various improvements in weaving, amongst which is a contrivance for obtaining an uniform and equal take-up of the cloth as it is woven by the agency of a roller, set or studded with pointed pins, which revolving points are in direct contact with the cloth being wound upon the take-up roller or beam. The pointed pin roller is the sole driver of the take-up beam; and being driven at an uniform rate by gearing in connection with the loom action, the pointed pin surface gives the same surface velocity to the take-up beam, whatever may be the condition of the winding on of the cloth—whilst the pins have a firm hold upon the beamed cloth, and derangement cannot occur from chance slipping. The second head relates to the adaptation of a screw movement for obtaining the necessary shifting traverse of the yarn or warp beam lever weights, ordinarily employed for producing a tensional drag upon the warp beam.

Fig. 1 of our engravings is an elevation of the back portion of a loom, showing one mode of working out this part of the invention, according to which the weighted automatic adjustment levers, A, are used, for giving tensional strain to the cords or ropes, B, which are wound round the friction pulleys, C, on the ends of the warp beam, D, in order to give the requisite tension to the warps; the other ends of the cords, B, being fixed to brackets, E, upon the stationary framing. The levers, A, are hung upon centre pins fixed to the stationary framing, and are made boxwise, or open, to receive longitudinal screwed spindles, to nuts working upon which the weights, F, are attached. Toothed wheels, G, are fixed upon the ends of the screwed spindles, so as to be driven by means of pitch chains which are passed round them, and round corresponding but smaller toothed wheels, H, fixed upon the ends of the warp beam spindles.

Fig. 1.



As the weaving action goes on, the motion of the warp beam, D, causes the screwed spindles of the levers, A, to turn and gradually shift the weights, F, nearer to the centres or *fulcra* of the levers, so as to act with diminished leverage upon the warp beam, as the quantity of warp upon the beam is gradually reduced by the weaving action.

Fig. 2.

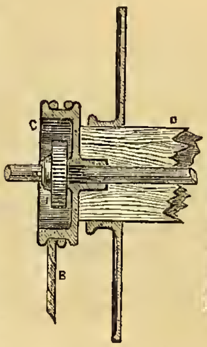
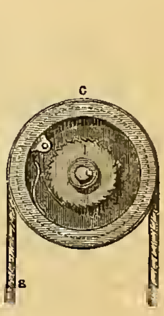


Fig. 3.



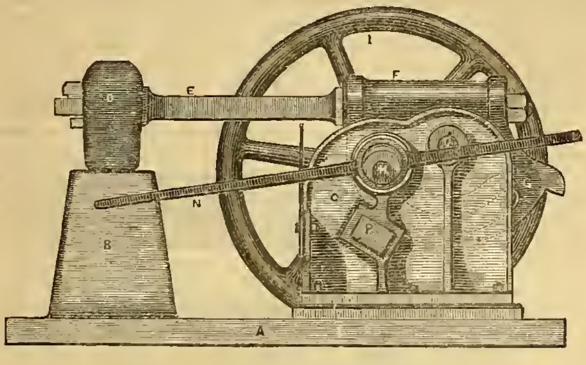
In working out the improvements comprehended under the third head of the invention, and represented in figs. 2 and 3—fig. 2 being a section, and fig. 3 an end view of the drag pulley and beam—a ratchet-wheel, I, is fixed upon the spindle of the warp beam, D, inside each of the friction pulleys, C; and palls jointed upon these pulleys, and provided with springs, act upon the ratchets, I, whilst the pulleys, C, are otherwise loose upon the spindles of the beam. The retarding strain of the weighted levers, A, acts upon the warp beam, D, through the ratchet-wheels, I, in one direction. The beam is, however, free to turn in the opposite direction when it is required to wind back upon it any portion of the warps, the ratchet arrangement admitting of this being done without taking the strain off the pulleys, C. When it is necessary to wind back upon the beam, D, any portion of the warps, the beam is turned by means of a hand-wheel in front of the loom, and on the end of a shaft which runs back along the side of the loom, and has fast on it a bevil pinion in gear with a bevil-wheel, J (fig. 1), fast on the spindle of the warp beam, D.

REVERSING MOVEMENTS.

J. Robertson, *Ardrossan.—Patent dated June* 6, 1855.

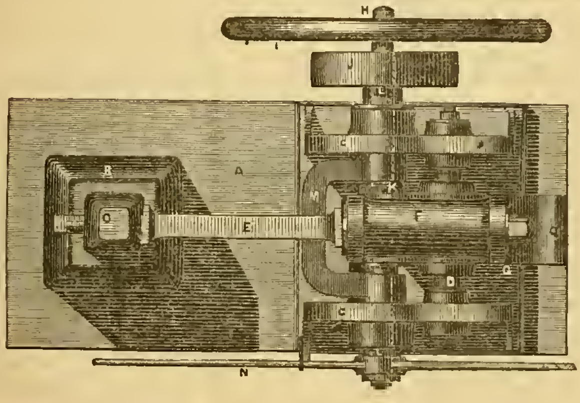
This ingenious invention, which is advantageously applicable to a great variety of machines, consists in transmitting rotatory, or partial rotatory driving motion, through a frictional driving pulley, arranged in bearings, capable of being turned in secondary eccentric bearings, the eccentricity of the latter bearings being just sufficient to set the pulley into or out of gear with the pulley or surfaces which it drives, or by which it is driven. According to one arrangement, the driving pulley is made to lie between the frictional surfaces of a pulley and a rim fast upon one disc, carried by the driven shaft. The motion of the driven shaft is reversed, by bringing the pulley out of contact from the internal surface, and into contact with the external surface of the central pulley, or *vice versâ*, by shifting or partially turning the bearings of the driving shaft in their eccentric seats. In this case, the motion in one direction is more rapid than in the other, a very convenient result for a variety of machines. Out of the many applications of this reversing movement which the patentee gives in his specification, we have selected for illustration a simple and effective arrangement of forge hammer; fig. 1 of our engravings being a side elevation, and fig. 2 a plan thereof. In this case it is only partial rotatory motion that is required.

Fig. 1.



The framing of this apparatus consists of a sole plate, A, upon which the anvil, B, is cast or fixed, and upon which two cast-iron side standards, C, are bolted down. In these standards are eyes for the spindles, D, upon which the hammer lever, E, turns or swings. The hammer lever, E, is fixed in a swinging block, F, formed below with a segmental aperture, G, the inner and outer surfaces of which are described with radii from the centre, D. Through the aperture, G, is passed a shaft, H, which carries a fly-wheel, I; a pulley, J, to receive a driving belt from an overhead shaft; and a frictional driving pulley, K. The pulley, K, is grooved circumferentially, as are also the circumferential surfaces of the aperture, O, to give the pulley increased frictional holding power upon them. The shaft, H, is passed eccentrically through bushes, L. connected together by a bow-piece, M; and the bushes, L, are capable of turning in bearings in the side standards, C, having a double-armed lever, N, fixed upon one of them, for turning them by. The shaft, H, being in continuous motion, a slight movement of the lever, N, causes the pulley, K, to enter into contact with the internal surface of the outer rim of the segmental aperture, O, in the swinging block, E, of the hammer; and by turning this block, to lift the hammer, O. When the hammer is raised sufficiently, the lever, N, is shifted, so as to bring the pulley, K, into contact with the inner side of the segmental aperture, G, which has the effect of not only allowing the hammer to fall, but also of aiding its descent by imparting a partial rotatory motion to the swinging block, F, in the opposite direction to that of the lifting motion; the lesser radius of the inner side of the aperture, G, causing a greater speed to be imparted to the block upon the descent than upon the ascent of the hammer. Or, by shifting the pulley into a position midway between the two sides of the segmental aperture, G, the hammer may be allowed to fall by its own gravity. A block of wood, P, is passed across between the standards, C, for a catch, Q, on the swinging block, F, to strike against, to prevent the hammer being turned up too far.

Fig. 2



We propose, on some future occasion, illustrating some further useful applications of Mr. Robertson's important invention.

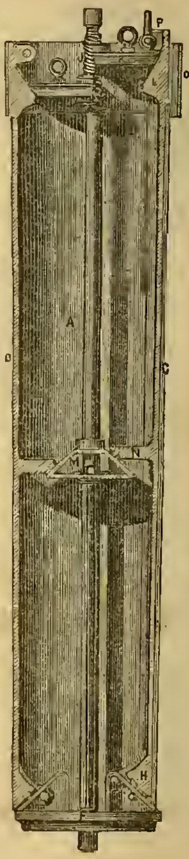
MOULDING METALS.

J. Page, *Perth.—Patent dated June* 25, 1855.

In casting pipes or other hollow articles of cylindrical or similar contour, according to this invention, core bars, capable of expanding and collapsing in diametrical dimensions, are employed; these core bars being each composed of four longitudinal pieces of curved metal, or segmental metal plates combined together with their longitudinal junction edges in contact with each other.

Fig. 1 of our engravings is a vertical section of the improved core bar, one half of the figure being shown in its complete expanded state, whilst in the other half the smaller segment is shown as drawn in towards the centre. Fig. 2 is a plan, each half of which corresponds to the respective half of fig. 1. The cylindrical or external surface portion of the core bar is composed of four segmental pieces, A, B, C, D; the segmental pieces, A, B, are larger than the other two, C, D, and whilst all the four pieces fit together with inclined edges, as seen in transverse section, the two smaller pieces are tapered longitudinally downwards, so as to free themselves from the edges of the adjacent segments when slightly raised up from these last. These segments are disposed round a central spindle or adjusting shaft, E, which projects longitudinally beyond their extreme ends, and is fitted at its lower end with a circular disc, F, slightly less in diameter than the largest dimension to which the core bar is to be expanded. The inner face of this disc has upon it two diametrically opposed inclined pieces, G, against which, face pieces, H, upon the lower ends of the smaller segments, C, D, bear. The inclined guide pieces, G, slope inwards from the circumference of the disc, and are open to receive pins, I, carried by lugs upon the segments, C, D, so that these segments are retained, and guided in both directions. The opposite extreme end of the spindle is screwed for a short distance, as at J, to receive a disc nut piece, K, the circumference of which is bevilled in a direction the reverse of the pieces, G, at the other end of the bar. The bevilled circumference of the disc nut, K, bears against corresponding reversed inclines, L, on the inner faces of the segments, C, D, at their upper ends. By screwing down the disc nut, K, into the position in which it is represented on the left-hand side of the figures, the segments, C and D, are pressed downwards and outwards, being guided accurately below by the guides, O. If necessary, additional guides, M, may be fixed upon the spindle, E, at any intermediate point between its opposite ends; lugs with suitable face-pieces, N, being formed or fixed upon the segments, C, D, at the corresponding points thereof. The upper ends of the four segmental plates, A, B, C, D, are held together by a deep wrought-iron ring, O, shaped internally to the extreme diameter to which the segments are to be expanded, allowance being made for the formation of ridges upon the portions of the segments covered by the ring, for the passage of air between such ridges. When the core bar is required to collapse, the disc nut, K, is unscrewed so as to permit of the segments, C, D, being raised by means of the lugs, P, the action of the guides, G, at the bottom causing these segments to recede towards the central spindle, E, as they are being raised. After this the two larger segments, A, B, can be easily drawn in towards the central spindle, when the entire core bar can be removed from the casting.

Fig. 1.



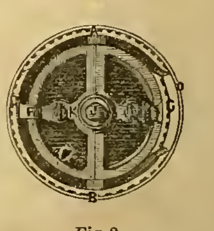


Fig. 2.

Retaining catches of various kinds may be used for the upper adjusting end of the core bar, instead of the details already mentioned. Or, the top of the core bar may be secured by bolting two of the segmental plates, which have their narrow ends uppermost, by means of wedge bolts passing across the end of the bar; when these wedge bolts or other retainers are removed, the two segmental plates which have their narrow ends downwards, and which may be called the small plates, being attached to the crane, may be elevated a short distance, when the other two segmental (large) plates are allowed to collapse. A simple screw nut, combined with two radial-hinged catches, may be used for the adjusting action, instead of the arrangement described. The downward pressure of the nut causes the hinged catches to expand the segmental core bar plates; whilst, on the elevation of the nut, the two primarily lifting segments may be taken up to clear, as before mentioned. The core bars, whether collapsable, or plain and solid, are coated in a superior manner in a vertical mould box, prepared a little larger in diameter than that of the intended core, this difference being an allowance for shrinkage of the loam. This vertical moulding chamber is enveloped in a steam chamber, to dry the loam used for coating the core bar. The loam is mixed with water at a good heat, in an iron vessel maintained at an elevated temperature by steam. In coating solid core bars, the bar is made with a considerable longitudinal taper, and the small end is placed downwards with a loose ring at its bottom; in this condition it is passed into the mould box, and made to revolve at a uniform rate, by the action of any convenient prime mover. The heated loam is then permitted to flow down from a hopper into the annular space between the exterior of the core bar, and the interior of the mould box. As the core bar rotates, it carries down and forces the loam into its place; and the heat involved in the operation dries the loam coat almost as quickly as it is laid on. Plain tapering but solid core bars may be coated in this way, without the use of straw or any other material between the core bar and the loam. The core bar may be made to revolve in the loam after the pipe is cast, so as to be withdrawn from the centre of the pipe without difficulty.

POTATO DIGGER.

John Hanson, *Doagh, Belfast.—Patent dated July* 30, 1855.

This new implement, of the successful trial of which we have already given an account,* is represented in the accompanying engravings, fig. 1 being a side elevation, and fig. 2 an end elevation. The digging details are carried by a long light timber frame, supported upon two pairs of running wheels, the front pair being of comparatively small size, and serving merely to support the front end of the machine. The machine is drawn along by means of a transverse bar, fixed across the front ends of the longitudinal pieces of the framing, and this transverse bar is made to project on one side to serve as a lever handle, by means of which the machine is turned at the headlands. The two horses by which the machine is drawn are attached to a ring, capable of adjustment upon a vertical bar, carried by the transverse frame bar, and connected to another cross bar on the framing behind by a curved branch. The front small running wheels are carried in forks, which are fixed in a transverse spindle, and this spindle is carried in bearings upon brackets fixed to the framing, and has fixed to it a lever, by means of which the forks can be set at any angle, so as raise or lower the level of the wheels, this adjustment tilting the machine more or less, and determining the acting level of the working details at its opposite end. The tilting lever is fixed in any required position by means of a catch-plate. The main wheels are of large diameter, and are furnished on their peripheries with projecting spikes, which enter the ground, and insure the turning of the wheels, so as to drive the digging details as the machine is drawn along. The wheels are themselves loose on the shaft or axle, but the latter has keyed upon it, at each end, a crank, which gears with a stop fixed upon the nave of the wheel, by means of which the rotation of the wheels causes that of the shaft. This shaft carries a pair of large bevil wheels fitted upon it, with grooves and feathers, so as to be adjustable transversely, as regards the machine, by means of a clutch and lever. In the central space between the two bevil wheels, and fast on a horizontal shaft, lying longitudinally as regards the machine, is placed a bevil pinion, arranged so as to be driven by either of the bevil wheels, accordingly as these are adjusted by the lever. The longitudinal shaft is carried in bearings upon the cross pieces of the framing, and projects beyond the extreme hinder end of the framing to receive the rotatory digger disc. This disc is fast upon the shaft, and has bolted to it a number of digger forks. As the machine is traversed along, these forks revolve rapidly in a plane at right angles to the line of traverse, and entering the drill or ridge of potatoes, scatter these out from the earth. The earth and potatoes are primarily lifted by means of a species of inclined plough-plate, which is carried by an arm at one side of the back end of the framing, and is situated with its front lower point in advance of the digger forks, so as gradually to raise up the earth and potatoes to the digging forks. As it is desirable, in digging a large field of potatoes, to throw the potatoes always towards the same side of the drill or ridge which is being dug, whether the machine be traversing this ridge in one direction or the other, the duplicate bevil wheels are employed as already described, so that the rotatory digging forks may be driven in either direction. And as the arm of the plough-piece would be in the way of the potatoes which the forks throw out, when rotating in the reverse direction to that for which the machine is represented in the drawing as set, this arm is hinged, so that the plough-piece can be turned up out of the way, whilst a duplicate plough-piece, carried by an arm on the other side of the framing, and represented in the figures as turned up, is turned down. The plough-pieces are each held fixed in an elevated position, when required, by a pin passed through a pair of lugs upon the framing, between which lugs the supporting arm lies when turned up. When turned down, the plough-piece is secured by a hinged piece fastened by a pin, as shown in fig. 1. A curved bar is fixed near the front end of the framing, for the purpose of turning down on each side the above-ground portions of the potato plant, as the machine traverses along.

Fig. 1.

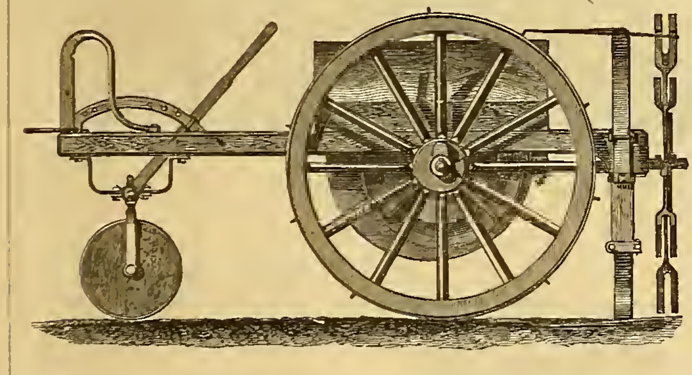
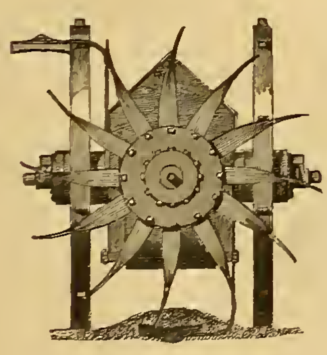


Fig. 2.



Amongst the various modifications of which the hereinbefore described apparatus is susceptible, it may be deemed, in some cases, desirable to fit a pair of coulters, with small mould-shares, on each side of the framing, in advance of the digging details, for the purpose of paring off the sides of the drills, so as to leave a diminished width of drill to be lifted by the plough-piece, or elevator. A screen may be fitted to the machine to prevent the potatoes from being thrown too far or too high; this screen consisting, for example, of a curtain of sacking or netting suspended, in the course of the stream of potatoes, from a suitable arm, fixed upon and projecting laterally from the framing. The potatoes being thrown against this screen, will fall from it, so as to be deposited in a regular row as the machine passes along.

SULPHURIC ACID AND SULPHATES.

J. H. Johnson, *London and Glasgow*, (Persoz, *Paris.*)—*Patent dated May* 11, 1855.

In carrying out this invention, two processes are employed—the first has for its object the production of sulphurous acid gas, to be afterwards oxidized; and the second consists in decomposing this gas by the aid of sulphuretted hydrogen and steam. In oxidizing sulphurous acid, two well-known processes are employed. In the first, nitric acid is used for oxidizing the sulphurous acid, and converting it into sulphuric acid. But, according to the present system, the sulphurous acid is directed through nitric acid heated to a temperature of about 100°, being previously diluted with from 4 to 6 times its volume of water. Or the sulphurous acid may be directed through a mixture of nitric and muriatic acids. The second process consists in the oxidation of nitrous vapour or chloro-nitrous acid, and in transforming it into nitric acid by means of oxygen, obtained from the atmosphere, or from any other source. By this system of manufacturing sulphuric acid, the leaden chambers hitherto employed are dispensed with. Sulphurous acid gas disengaged by any of the reactionary processes capable of producing it, may also be employed, either pure or mixed with nitrogen, carbonic acid or oxide, and hydrogen, for making sulphuric acid by the improved process, as well as from sulphurous acid produced from the combustion of sulphur and certain qualities of pyrites. By this process, also, the nitrates of potash and soda, and the chlorides of the same, may be converted into sulphates of potash and soda, both one and the other being previously dissolved in water, to which, in the case of the nitrates, a certain quantity of muriatic acid has been added, and, in the case of the chlorides, nitric acid, so as to develop in each case the chloro-nitrous vapour, for the purpose of transforming into sulphuric acid, the volume of sulphurous acid necessary for converting into a sulphate the entire base of the nitrate or chloride employed. The liquid is afterwards concentrated in the distilling chambers, to expel the excess of hydrochloric and nitric acids. The sulphurous acid employed may be obtained by various processes.

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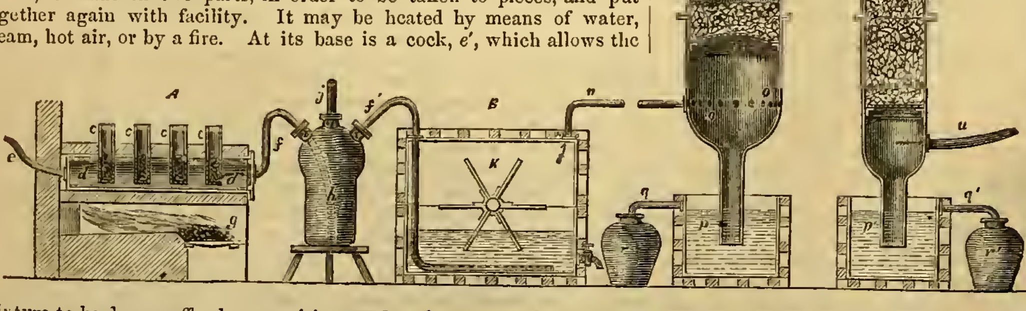
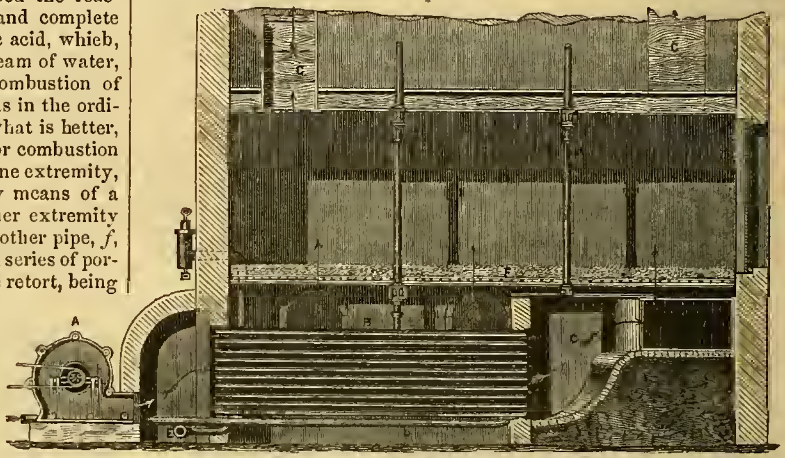
* Page 190, Vol. VIII., *P. M. Journal.*

The apparatus which is by preference employed in working out this system is composed of three distinct parts, A, B, and C, as represented in the annexed figure. The 1st part, A, varies in its form and arrangements, according to the materials used for the production of the sulphurous acid necessary to the preparation of sulphuric acid. The 2nd part, B, serves to bring the sulphurous acid into contact with the diluted nitric acid. And the 3rd part, C, consists of a chimney or column containing porous material, in which all the gaseous bodies which have escaped the reaction produced in the second part enter by the openings, *o*, and complete their mutual action, and effect a last analysis of the nitric acid, which, slightly charged with sulphuric acid, is carried off by a stream of water, and is delivered into a portable reservoir, *p*. For the combustion of the sulphur, which cannot be performed in the open air, as in the ordinary process, it is preferred to use a cast-iron cylinder, or, what is better, an earthen retort, *d*, similar to a gas retort. Such retorts or combustion chambers are heated by means of fires, *g*, below them. At one extremity, a tube, *e*, is introduced, through which air is supplied by means of a blowing machine of any suitable form; whilst, from the other extremity of the retort, the sulphurous acid gas is carried away by another pipe, *f*, which conducts it to the nitric acid to be oxidized thereby. A series of porous earthen tubes, *c*, are introduced into the upper part of the retort, being open at their upper ends, which should project two or three inches above the retort, and closed at their lower extremities, which should be inside the retort. These cylinders, having been previously well luted to the openings in the retort made to receive them, are filled with sulphur. If the retort is now heated, the sulphur, soon entering into fusion, will leak through the pores of the tubes, and falling into the heated retort will be burnt therein. Thus, the part of each tube which is in the retort will be surrounded with flame, which will be kept up by the air, and by the dripping of the sulphur. The tube, *f*, for carrying off the gas, instead of being passed directly to the mixing chamber, B, communicates with one of the three tubes, *i*, of the intermediate vessel, *h*, serving as an indicator, and composed of earthenware, glass, stone, or other suitable material. This vessel also contains a vertical air-tube, *j*, which is furnished with a cock, for the introduction of such a quantity of air as will contain a volume of oxygen, equal to about half of that of the sulphurous acid supplied from the retort. Another tube, *f′*, is also fitted to this vessel, to conduct the air and acid to the mixing chamber, B, spreading it out equally through the liquid, by means of a number of small holes pierced in the lower part of the tube which is immersed therein. This liquid is composed of nitric acid and water, and the mixture is constantly disturbed by an agitator, K, which is driven from the outside at a convenient speed. The receiver, B, which encloses the whole, is made in two parts, in order to be taken to pieces, and put together again with facility. It may be heated by means of water, steam, hot air, or by a fire. At its base is a cock, *e′*, which allows the mixture to be drawn off when requisite; and at its upper part there is an opening, *m*, which receives the tube, *n*; such tube being prolonged, and entering the bottom of the chimney or column, C, before mentioned. Several openings, *o*, may be formed round the base of the chimney to receive the tubes, *n*, and the base of the chimney is prolonged downwards, and enters the cistern, P, which is furnished with a waste-pipe, *q*, to carry away the excess of nitric acid into the vessel, *r*. The interior of the chimney or regenerating column, C, is divided by partitions, *s*, pierced with holes, and serving to support the porous material before referred to, and through which the acids which have just been mixed pass. A jet of water is introduced into the chimney at its upper part, *t*, and carries down the nitric acid into the lower basin, P. A second chimney, C′, similar to, and in communication with the first one, completes the operation, the gas being forced to descend by means of an exhausting machine in communication with the chimney by the tube, *u*. A basin, P′, similar to the preceding one, and furnished also with a waste-pipe, *q′*, receives the nitric acid, together with any small amount of sulphuric acid that it may still contain.



GRAIN-DRYING KILN.

John Weems, *Johnstone.—Patent dated June* 29, 1855.



We some time ago* remarked in emphatic terms upon the lamentable defects inherent in our present system of drying grain, both as regards the economics of the process, and, more importantly still, as affecting the health of the workmen employed in it. Since this time, Mr. Weems has given much attention to the subject, and his deliberations have resulted in the plans which we now illustrate. According to his invention, the grain to be dried is deposited in a layer upon a perforated floor, through which heated air is blown from below, the air being heated by passing in contact with metallic surfaces, themselves heated by steam. Our engraving is a vertical section of a grain-drying kiln, as arranged for carrying out this invention. The air is blown by means of the fan, A, through the heating vessel, B, into the duct, C, which distributes it over the ground floor of the building constituting the kiln. The heating vessel, B, is a metal cylinder, provided with a number of tubes, arranged longitudinally, for the passage through of the air, these tubes being enveloped by steam, with which the vessel is supplied by the pipe, D. The steam, which may be the exhaust steam of a high-pressure engine, driving the fans, is made to enter the vessel, B, at the end at which the air leaves it, the products of condensation being carried off by a pipe, E, at the opposite end. The air-duct, C, is provided with adjustable valves or doors, by arranging which the heated air may be made to emerge from the duct at any part of the ground floor of the building. The grain to be dried is deposited in a layer upon the floor, F, which is composed of wire-cloth, or other suitable permeable material, laid upon a network of beams, joists, and bars. The air passes up through this permeable floor, and through the grain upon it, and rapidly carries off the moisture from the latter, the used air and vapours finally passing off through the ducts, G.

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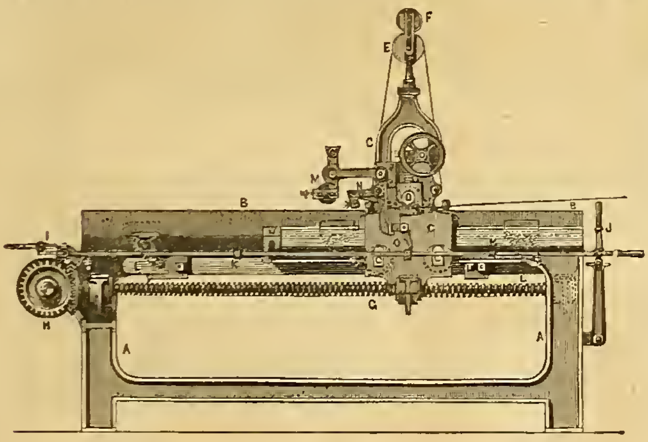
* Page 106, Vol. VI., *P. M. Journal*.

LITHOGRAPHIC PRINTING MACHINE.

D. Tannahill, *Glasgow.—Patent dated April* 17, 1854.

Our engraving is a side elevation, partly in section, of Mr. Tannahill's lithographic printing machine. The framing consists of the two rectangular cast-iron side standards, A, tied together by rods and by cross bars at each end, these cross bars serving to carry the bearings of two parallel screw shafts, G, by means of which the impression frame is made to traverse. Double V-slide rails are cast upon the outer top sides of the standards, A, and upon these rails the impression frame, C, traverses. This impression frame consists of two substantial castings, formed with slots to receive the bushes of the impression roller, D, which is of wrought iron. The pressure of the roller is adjusted by means of vertical screw spindles which are attached to the bushes, and are raised or lowered by nuts with small worm-wheels, K, formed upon them. These worm-wheels are each in gear with a worm on a horizontal spindle passing across the machine, and held in suitable bearings in the frame, C. Hand-wheels are fixed on each extremity of the spindle, and by means of them the bushes of the roller are lifted or lowered equally and simultaneously. A pair of counter-pressure rollers are carried in suitable bearings at the lower part of each of the frame pieces, C, these rollers bearing up against the under sides of the rails or sides of the framing, A, and being formed with V-shaped peripheries to correspond to the rails. A strong cross bar passing below the table is fixed to the lowest portions of the frame pieces, C, and carries a pair of screwed bushes, in which the screw shafts, G, work, thereby causing the frame, C, to traverse from end to end of the machine.

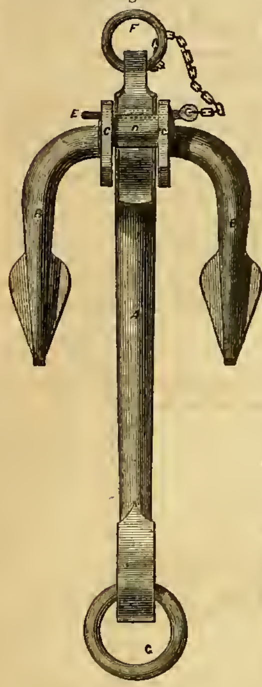


The screw shafts, G, have each a bevil wheel fast on one extremity, and the two bevil wheels are in gear with bevil wheels, H, on a transverse horizontal shaft, which is the first motion shaft of the machine, and is carried in bearings formed in bracket-shaped projections cast on the ends of the side standards, A. The first motion shaft carries a series of fast and loose pulleys, which are connected to an overhead or other revolving shaft by a pair of belts, one of which is open, the other being crossed. Immediately over the pulleys is carried in suitable brackets a rod, on which are two forks for shifting the belts; and the pulleys are so arranged that, on reversing the motion, one belt is first passed upon a loose pulley before the other belt passes upon a fast pulley. The rod, I, upon which the forks are fixed, is shifted by a lever oscillating on a stud carried by a transverse bar, to which the brackets are also attached. The other end of the lever is connected by a rod to a crank lever jointed at its other end to a rod, K, running along the side of the machine to the opposite end. The rod, K, has adjustable stop pieces fixed upon it, and a catch is fixed upon the frame, C, so as to embrace the rod, K, and come in contact with the stops as it traverses back and forward. As the frame with its catch reaches either stop, it shifts the rod, K, and thereby causes the motion of the machine to be reversed. The machine may also be reversed or stopped by hand when necessary, the rod, K, being formed with a handle at the end, and being connected by a gab to a spring band-lever, J, which is provided with a catch plate. The table, B, upon which the stone or plate to be printed from is fixed, is a strong and massive block or platform of wood, or other suitable material. It fits easily between the top sides of the standards, A, and is supported by three transverse shafts carried in bearings in brackets cast upon the insides of the side standards; these brackets also serving as guides for the table, B, to prevent its moving longitudinally. The table, B, has bearer pieces fitted upon its under side, immediately over cams upon the transverse shafts, these shafts each having two such cams. The cams are so shaped as to raise the table, B, by bringing their prominences under the bearer pieces, or to let the table sink a slight distance on the reverse action taking place. The cams on one side of the machine are formed with short tails or levers, I, the ends of these levers being jointed to a horizontal bar, so that by shifting this bar the cams may be turned equally and simultaneously. Adjustable stop-pieces are carried by the bar, these stops being arranged so as to be acted upon by catches on the bottom cross bar of the impression frame, C. Thus when the frame, C, reaches the driving end of the machine, the stop is acted upon, and the cams are shifted so as to raise the table, B, into contact with the impression roller, D; and on reaching the other end of its traverse, the frame, C, acts on the stop so as to cause the cams to turn in such a manner as to allow the table, B, to sink again. An endless cloth or belt is made to act as the tympan, and passes under the impression roller, D, round a pair of guide rollers, and over an upper roller, E, carried in slots in upright pillar pieces on the top of the frame, C. The fabric or material to be printed upon is drawn off a roller placed towards the right-hand end of the machine, or is fed to the machine in any convenient manner, being carefully stretched to prevent creases. It is passed under the impression roller, D, and proceeding along with the tympan is finally beamed or wound upon a roller, F, placed above, and resting upon the roller, E, from which it receives motion by frictional contact, rising in the slots of the pillars as its diameter increases from the accession of printed fabric. As the impression frame, C, traverses towards the driving end of the machine, the table is at a low level, and not in contact with the roller, D, and the frame draws the fabric over the stone or plate which is fixed upon the table, B. On the return traverse the table is elevated, and the roller, D, rolls along the printing surface, rolling up the fabric as it is being printed. The damping and inking operations may be performed by hand, or they may be effected by self-acting apparatus, such as that represented in the figure. The damper consists of a water trough, N, which is fixed across the impression frame, C; this trough being formed with a slot along its bottom from end to end, in which slot a number of folds or plies of flannel or other suitable material are fitted, and serve to communicate the requisite moisture to the stone or plate when traversing in contact with its surface. The slit in the bottom of the trough is made adjustable as to width by means of screws, so that the amount of moisture transmitted by the flannel may be regulated. The under surface of the damper, N, is at the same level as the impression roller, D; and as this last rolls over the stone or plate in the act of taking an impression, the damper follows it, preparing the stone or plate to be inked for a succeeding impression. The inking apparatus consists of an ink trough and a pair of inking rollers, M, carried by an oscillating frame, which depresses them so as to act on the stone or plate at the proper periods. The ink trough is triangular, and the ink issues by a slit along the bottom of the trough, the supply being regulated by screws, by means of which the width of the opening is adjusted. The ink is first communicated to the upper roller, which imparts it to the lower roller, M; and the upper roller is connected by a pitch chain with the impression roller, D, so that the rotation of the last causes that of the rollers, M, thereby effecting the uniform spreading of the ink. The frame oscillates on a transverse shaft; one of the brackets of which the frame consists being a crank lever with a pendant arm. The arm is acted upon by an eccentric piece, O, which is formed with a tail or short lever, so arranged as to come in contact with the stops on the reversing rod, K, these stops having projections suitable for the purpose; or adjustable stops may be put upon the stationary framing for this purpose. The lever is also acted upon by a spring, which causes the rollers to be depressed upon the stone or plate when the eccentric, O, is in such a position as to allow of this. When the impression frame, C, traverses towards the driving end of the machine, the rollers, M, are depressed, and ink the stone or plate until the lever comes in contact with the stop, when the eccentric, O, turns so as to elevate the rollers. On the return traverse, the lever comes in contact with the stop at the other end of the machine, and the eccentric, O, turns so as to allow the spring to depress the rollers on the stone or plate. The patentee particularises other modifications of apparatus for effecting the same results as that described.

ANCHORS.

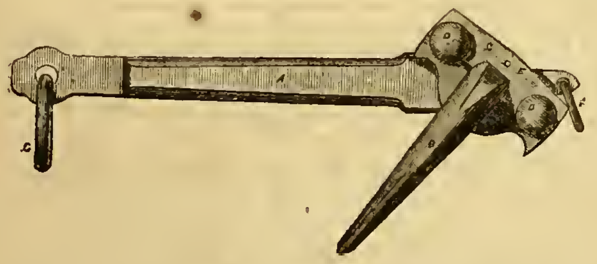
J. H. Johnson, *London and Glasgow*, (David, *Havre*.)
Patent dated March 29, 1855.

Fig. I.



M. David's anchor, which is constructed to act without a stock, and to hold by both flukes at all times, is represented in plan in fig. 1 of the accompanying engravings, and in side elevation in fig. 2, the anchor being represented in the latter as in its holding position, whilst in the former it is shown with the flukes closed or parallel with the shank for stowage on shipboard. The shank, A, is formed with a large eye near its lower end, through which a pair of arms, B, in the form of a horse shoe, is passed, being free to work in the eye of the shank within certain limits. The flukes or palms are placed in the plane of the arms, B, and both enter the ground when the anchor is holding. The flukes are made to assume their proper holding position, by means of the cheeks, C, and transverse pins, D, riveted into the cheeks. The cheeks cannot turn, except along with the arms, B, so that, when the anchor is dragged along the ground, the corners of the cheeks catch therein, and turn the flukes downwards, whilst the pins, D, determine the angle of the flukes with the shank, when the former are open, as shown in fig. 2, this angle being about 50°. When the anchor is to be stowed away on shipboard, the flukes are locked in the position in which they are represented in fig. 1, by means of a pin, E, passed through the cheeks and through the shank. A ring, F, is connected to the lower end of the shank for the attachment of a rope to facilitate the shipping and unshipping of the anchor. The usual ring, G, for the attachment of the cable is connected to the other end of the shank. Whilst this anchor possesses the advantage of great convenience in stowage on shipboard, it is also susceptible of easy manufacture, and with less risk of faults in welding or otherwise, than anchors of the ordinary construction, since it consists of separate pieces, each in itself presenting no difficulties of construction, and requiring no welds or joints likely to be weak internally, whilst perfect in external appearance. The eyes in the shank and cheeks are formed with elongations, to allow of the passage through of the flukes or palms, the rivets, D, being required to be loosened to permit of the separation of the parts. This is the second valuable contribution of M. David to the mechanism of navigation, which we have had occasion to bring before our readers. Our part for November last, contains an engraving and description of his ship's tiller apparatus, as shown in the Paris Exhibition, where was also an anchor of the kind just described.

Fig. 2.

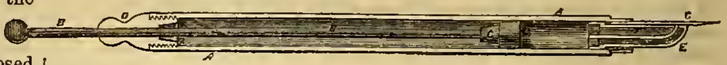


FOUNTAIN PENS.

J. H. Johnson, *London and Glasgow* (Prince, *New York*.)
Patent dated February 24, 1855.

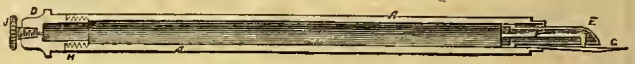
The chief improvements in these pens consist in the employment of hard vulcanized india-rubber in their construction, to avoid the ordinarily corrosive action of the ink, and in the use of a spring or tongue fitted into the tube which feeds the pen, and arranged to vibrate with the action of the pen in writing, so as to cause the ink to flow out freely to supply the pen. Figs. 1 and 2 of our engravings are longitudinal sections of two modifications of fountain pen, constructed on Mr. Prince's system. In the modification represented in fig. 1, the reservoir tube, A, is fitted with a piston, C, the rod, B, of which is of about the same length as the tube. The piston has a conical plug on its inner face, made to fit a conical seat in the screwed cap, D, of the tube, so that, when a supply of ink is drawn into the tube by drawing out the piston, the conical plug enters its conical seat, and, effectually closing the piston rod aperture, prevents the leakage of the ink outwards and the entrance of the air inwards. In the opposite end of the tube, A, is inserted a bent feeding tube, E, which has a central hole of about an eighth of an inch in diameter passing through it; near the lower end of the feeding tube, a lateral aperture is made for communicating the ink to the pen, G, and within the feeding tube a thin flat spring, F, is fixed, the upper end of which is made wide enough to bear upon the sides of the tube; the other end of the spring is narrow, so as to vibrate freely within the tube by the action of the pen in writing. The lower end of the spring is bent round, so as to project through the aperture and come into contact with the under side of the pen, G. When in writing the pen is pressed off the orifice in the feeding tube, the point of the spring, F, follows it, and by its constant motion aids the flow of the ink to the pen, being itself always in contact with the pen, and so keeping up a line of communication therewith for the ink.

Fig. 1.



In the modification represented in fig. 2, the feeding tube, E, is placed above the pen, G, and in this case the end of the spring, F, is formed with a conical plug, which fills the feeding orifice, except when the pressure of the pen in writing raises the plug within the tube, and allows the ink to flow out. Thus, the ink can only flow out when the pen is in actual use, the orifice being closed at other times. In this modification the piston for drawing the ink into the reservoir is dispensed with, and a mouthpiece, D, is screwed into the end of the tube, having a small orifice, through which the air is withdrawn from the tube by suction, the ink being drawn up into it. The orifice is closed by a small screw plug, J, to prevent the entrance of air, or the escape of the ink. A tubular cap is provided to fit over the pen end of the instrument, so that it may be carried safely in the pocket.

Fig. 2.



LOCKS.

C. Henderson, *Tufnell Park, Middlesex.—Patent dated May* 11, 1855.

Mr. Henderson increases the difficulty of opening a lock of any ordinary construction by a pick or false key, by adapting to the outside of the face-plate of the lock a species of auxiliary lock, into which admittance has first to be had before the key can enter into the main lock. One modification of the contrivances for working out this invention is represented in the annexed figures 1, 2, and 3. Fig. 1 is a front elevation of the

Fig. 1.

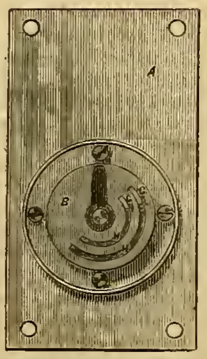


Fig. 2.

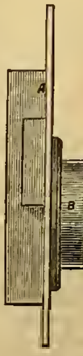
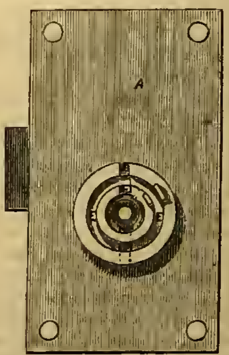


Fig. 3.



lock, showing the external auxiliary lock upon the face-plate; fig. 2 is an edge view, partly in section; and fig. 3 is an elevation, with the external casing of the auxiliary lock removed, to show certain split rings which form a part of the contrivance. The internal arrangement of the main lock, A, may be of any known kind, and is not interfered with by the auxiliary or protector lock, B, attached to it externally. The position of the keyhole in the auxiliary lock is exactly the reverse of that of the main lock, and the key, after being entered into the outer lock, has to turn half round before it can find its way into the main lock. Inside the auxiliary lock are placed two or more split rings, as seen in fig. 3, and which are concentric with the pin of the main lock, being arranged to work circularly round fixed wards, E, in the auxiliary lock. The openings, F, in the rings serve for the introduction of the key; this key, after being entered into the auxiliary lock, is turned half round, carrying the rings with it, so that these cover the outermost keyhole in the auxiliary lock. The half turn brings the bit of the key opposite the keyhole of the main lock, when the key can be entered into the main lock, and the bolt be shot in or out; when taking out the key after withdrawing it into the auxiliary lock, it is turned half round, carrying the rings with it, until its bit becomes opposite to the external keyhole of the auxiliary lock. The rings thus always cover one of the keyholes, so that no instrument can be introduced into the main lock, unless it can be got in through the narrow space corresponding to the thickness of the pipe of the key. Small studs or stops, G, are formed upon each ring, and work in the semicircular slots, H, in the inner cap of the auxiliary lock. A flat metal spring fitted inside the outer cap, which is supposed to be removed in fig. 1, presses upon the stops, G, and prevents the rings from being shaken or jerked out of position.

In figs. 4 to 7 is represented another modification of auxiliary lock, comprehending some additional contrivances for increasing the security thereof. In this modification a single ring, or an equivalent disc, A, is used. Fig. 4 is an elevation of an ordinary lock, with the auxiliary lock applied to the outside of the keyhole, the outer cap of the auxiliary lock being removed. Fig. 5 is a similar view with the ring or disc, A, removed, and shows the wards and catches. Fig. 6 is a transverse vertical section, and fig. 7 is an inside face view of the disc or ring, A. This ring, A, is formed with a ring of ratchet teeth, into which catches, B, acted upon by the springs, C, enter, so as to prevent the ring from turning except in one direction. If a key is entered into the lock for the purpose of taking an impression of the wards, F, it will turn until it comes up to the wards, but the ratchet arrangement will prevent its turning in the opposite direction for removal, so that it will be held firmly in the lock, and will effectually prevent any farther attempts at picking it. A spring catch, riveted in the inside of the auxiliary lock, works in the notches, E, in the lower edge of the keyhole in the ring, A; this catch is protected by the concentric wards, F, which work through the same notches, E, in the keyhole of the ring. A slight projection is formed at H, on the face-plate of the main lock, to act as a slight resistance to the key, so that on turning the key the position in which it coincides with the keyhole will be readily known by feeling the projection, H. A notch is made in the periphery of the ring for a similar purpose, a blade spring, J, entering it when it comes round; another similar notch is made at K, for the entrance therein of the spring, J, to indicate when the key is brought opposite to the keyhole of the main lock. If a skeleton key is introduced into this lock so as to pass over the wards, F, the ring, A, will turn round until one of the notches, E, is brought against the angular end of the spring catch, already mentioned as riveted to the inside of the lock, and in this position the ring cannot be turned any further forward; the ratchet arrangement preventing the return of the ring, the skeleton key will thus be caught and held fast in the lock. When the true key is inserted, it passes the wards, F, and depresses the spring catch, so that the ring is not caught by this last. The projecting ring, L, fixed on the face-plate of the main lock, acts as a guide for the ring, A, which is formed with a groove to fit the guide, whilst a shield or cap, M, is secured to the main lock, and covers and conceals the entire mechanism.

Fig. 4.

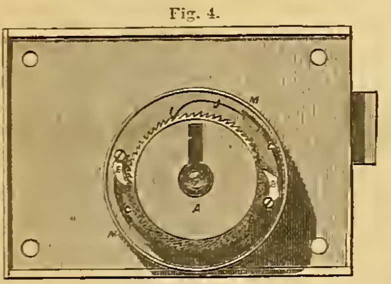


Fig. 5.

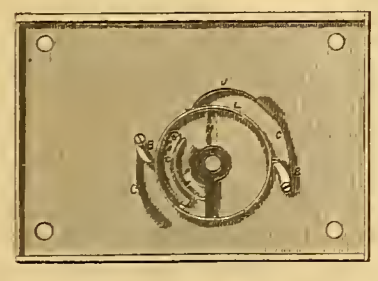


Fig 6.

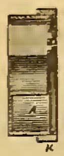
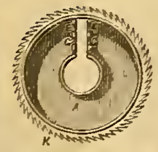


Fig. 7.



ELECTRO-MAGNETIC ENGINE.

J. H. Johnson, *London and Glasgow*, (Avery, *New York*.)

Patent dated December 22, 1854.

Fig. 1 of our engravings is a side elevation of Mr. Avery's electro-magnetic engine; fig. 2 is a sectional plan, the section being made along the line 1—2 in fig. 1. Fig. 3 is a plan, on an enlarged scale, of the under side of the middle cross bar, G'', of the framing. The framing, A, of the apparatus is composed of any suitable material, and is fitted with cross bars for supporting the magnets and revolving axis, B, B'. Two pairs, or four fixed electro-magnets, B B', are used, two of which are vertical and two horizontal, having their holes converging towards a common centre. These magnets are attached to the cross bars of the frame by the screw bolts, C, and are fitted with coils of insulate copper wire, D, wound round the connecting bends, E, of the magnets. The copper wire is wound in the usual manner for making electro-magnets, that is, the magnets, B B', are made to be in pairs of one circuit, and have opposite polarities for the purpose of exercising opposite attractive forces on the two ends of the axial magnetic levers. The revolving magnetic axis, F, is supported on centre pins, G, carried in the side rails, G', G'', of the framing, and has attached to it a fly wheel, H, and fitted with two sets of revolving magnetic lever arms, I. These lever arms, I, are attached at their centres to the revolving axis, F, and extend from it,

Fig. 1.

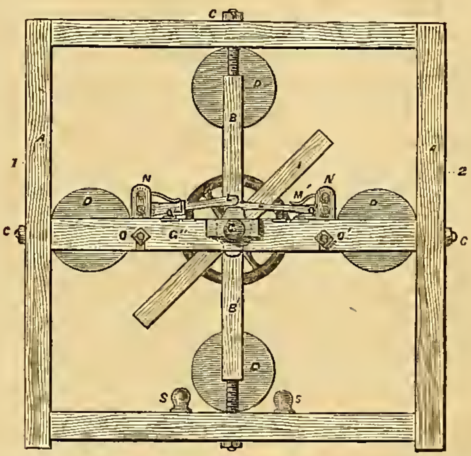
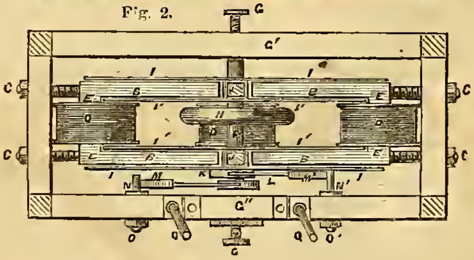


Fig. 2.



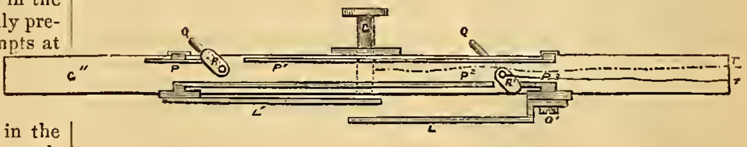
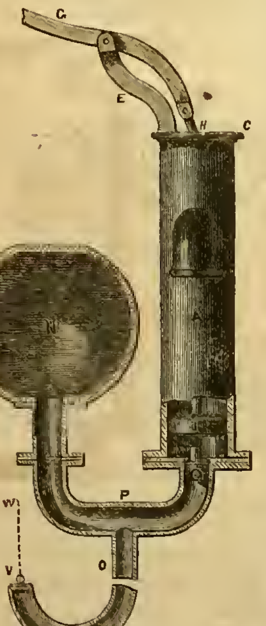


Fig. 3.

on each side, the length of the legs of the stationary magnets. Each set of these levers, that is, I and I′, are attached to the axis with barely space enough between them for the legs of the fixed magnets, so that the revolving magnetic levers always remain within the influence of the fixed magnets. Two brass collars, or bosses, J, are fitted upon the axis between the magnetic levers, I and I′, to prevent the magnetism at the extremities of the fixed magnets from acting upon the axis, F. Two cams, K, are attached to the revolving axis, for the purpose of breaking and changing the direction of the magnetic current, as they revolve from the vertical to the horizontal fixed magnets alternately. Two palls or circuit closers, L, L′, are acted on by the cams, K, and react by means of compressing springs, M, M′, attached to the support pieces, N, N′. These support pieces are attached to the rail or cross bar, G″, by the screws, O, O′, and are in contact with, or attached to the strips of brass, P, P′, P^2, P^3, which are secured to the under side of the rail. The working centre pins of two small levers, Q, Q′, pass down through the cross bar or rail, G″, and are attached at their lower extremities to the buttons, R, R′, for the purpose of reversing the electric currents, and the direction of rotation of the engine. Two binding screws, S, S′, are fixed in the lower cross bar, for the purpose of making connections with the battery. When the several parts are in connection with the battery, and the cranks or buttons, R, R′, are placed at right angles to the cross rail, there will be no magnetic action through the engine, but on turning the cranks or levers, Q, Q′, to the left hand, so as to bring the buttons, R, R′, into contact with the strips, P and P^3, respectively, a circuit will be established through the support piece, N, the pall or circuit closer and breaker, L, cam, K, axis, F, revolving lever magnets, and the vertical fixed magnets, thereby causing the axis and levers to revolve from right to left by the attractive forces of the vertical fixed magnets and revolving magnetic levers, until the latter get nearly parallel with the vertical magnets, whereupon one of the cams, K, breaks the circuit through the vertical magnets, and the other cam establishes it through the horizontal fixed magnets, which continue to attract and increase the power of the leverage until the revolving magnetic levers are nearly on a line with them, when one of the cams, K, breaks its circuit, and the other cam again establishes it through the vertical magnets, which again exert their attractive force at the bottom or heel of the magnetic levers, continuing its increasing or multiplying force on the magnetic levers at the opposite sides of their fulcrum, until these are nearly parallel as before, whereupon the current is changed to the horizontal magnets again, and so on alternately, the magnetic levers continuing their rotation. In order to reverse the direction of the rotatory motion of the magnetic levers, the cranks, or small reversing levers, Q, Q′, must be turned to the right hand, so as to bring the buttons, R, R′, into contact, respectively, with the strips, P′, P^2, when the direction of the currents will be changed so as to pass through the support piece, N′, pall, L′, and cam, K′, to the axis, F, and magnetic levers, and horizontal fixed magnets, whereby a continuously rotatory motion from left to right is produced.

Fig. 1.



LIFTING AND FORCING PUMPS.

T. BINCKS, *Wentworth.—Patent dated January* 29, 1855.

One modification of Mr. Bincks' lifting pump is shown in partially sectional elevation in fig. 1 of our engravings, the pump barrel being shown in section and upon a larger scale in fig. 2, whilst the bucket and valve are shown detached and in different positions in fig. 3. The barrel, A, of the pump may be composed of galvanized iron, with a copper lining, n, covering the working part of the barrel. This pump is entirely closed at the top by the cap, C, which may be soldered on to the barrel, A. The cap is cast with a sunk well or cup, D, as well as the bracket standard, E. The bottom of the cup, D, serves as a guide to the bucket-rod, F, which is connected to the lever, G, of the pump by the short link, H, which is almost entirely concealed in the cup when the bucket is down. The bucket, I, is made of brass, having a groove or recess formed round its periphery to receive the requisite packing, K, which for rain-water pumps may consist simply of a strip of gutta-percha heated and lapped round the bucket, the gutta-percha projecting slightly beyond the edge of the metal of the bucket, which is made rather smaller than the bore of the barrel of the pump. For other pumps the packing may consist of a strip of leather placed loosely round the bucket, the abutting ends of the leather being slightly bevilled off, and made to form a flush joint. The bucket is screwed upon the end of the bucket-rod, and is formed with suitable openings or water-passages, L. The valve, J, of the bucket consists simply of a disc of metal, M, faced on the under side with a disc, N, of leather or gutta-percha, which is secured to the metal disc by means of leaden pins or rivets, so that when the packing of the valve is worn, it may be easily removed by cutting away the leaden rivets, and a fresh piece of leather or other packing applied. A central opening, O, is made in the valve through which the bucket-rod is passed, the valve thus resting upon the top of the bucket, and being allowed to rise and fall freely along the bucket rod, its motion being limited by the small stop-pin, P, passed through the bucket-rod at a proper height above the valve. The foot valve, Q, of the pump is of a similar construction to the bucket-valve, the short rod or guide for the valve to work upon being made in one piece with the metal seating of the valve. Immediately below the pump, or in any other suitable and convenient situation, is fitted the air-vessel, N, fig. 1. This air-vessel is connected at its top with the barrel of the pump by the pipe, P. The tail-pipe, O, of the pump is connected with the pipe, P, and passes down into the well or cistern, and is turned up at its lower end to receive the valve, V, the use of which will be shortly explained. Fig. 4 is an external side elevation of Mr. Bincks' improved lifting and forcing pump. The working part of the barrel, A, of the pump is constructed similarly to that of the lift pump, being lined with copper at B. An air-vessel, C, is soldered on to the top of the barrel, and is cast with a sunk well or cup, D, for the purpose of guiding the bucket-rod, E, which is passed through a stuffing-box, F, in the bottom of the cup, D. A link, G, serves to connect the bucket-rod with the lever, H, which works on a fixed centre in the top of the bracket, I, cast on the top of the air-vessel. A spout, J, is fitted on to the air-vessel, and a bent pipe, K, descends from this spout to the lower portion of the air-vessel. The bucket, L, and foot valve, M, may be of the same construction as those represented in fig. 3. A second air-vessel, similar to that shown in fig. 1, may be fitted upon the suction-pipe of the force pump, fig. 4. The spout, J, may be constructed with two outlets, the outlet, Q, being used when the water is not required to be forced or elevated, and the outlet, R, which is in communication with the pipes for carrying the water upwards, being used for forcing the water to great elevations. A flexible pipe or hose may be readily attached to the outlet, Q, and the pump may then be used either as a fire engine, or as a garden engine. The communication through the outlet, R, with the forcing pipes remains always open, but by turning the hollow

Fig. 2.

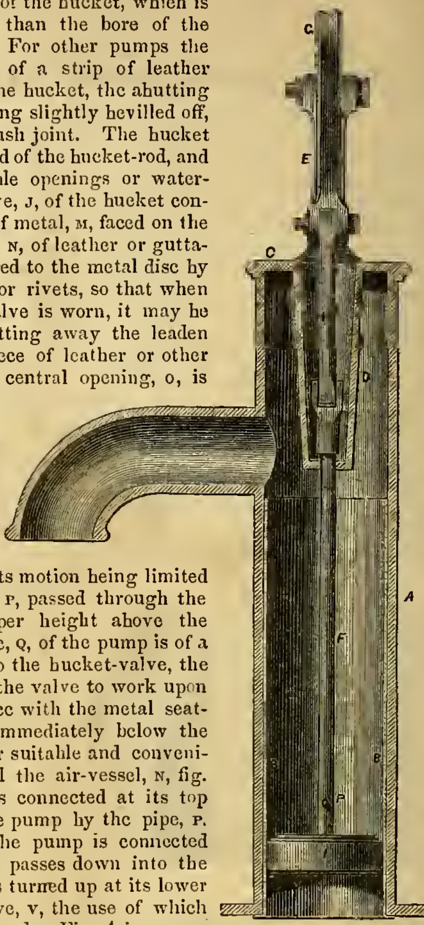
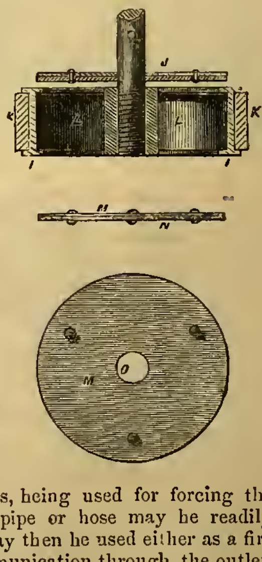
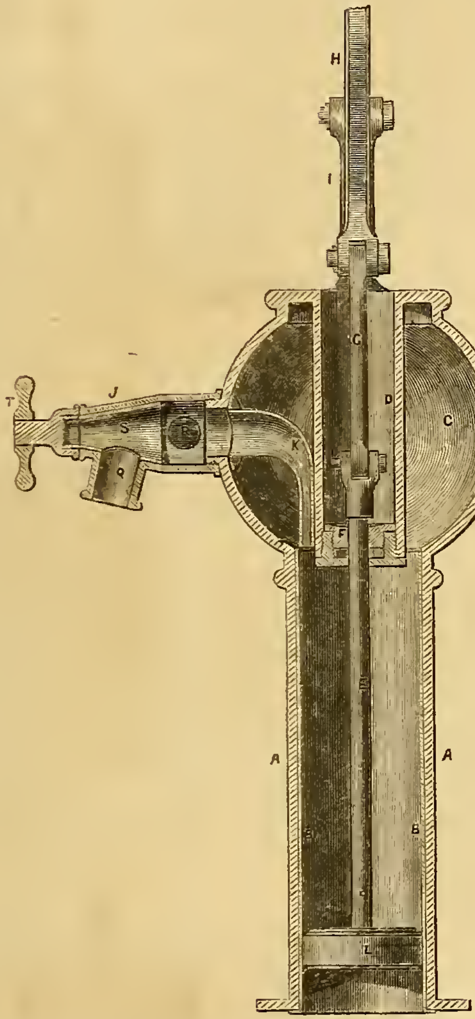


Fig 3



conical plug, S, inside the nozzle, the passage through the outlet, Q, will be closed when the water is to be elevated through the outlet, R. In order to start the pumps after they have been put up, a little water is poured into the barrel, and the bucket is then worked until the water in the well is raised sufficiently high in the tail-pipe, O, fig. 1, to completely fill it. The small valve, V, is then placed on the mouth of the tail-pipe by means of a cord or wire, W, by which it is suspended. The mouth of the tail-pipe being thus closed, the bucket of the pump is again worked to exhaust a certain amount of air from the air-vessel, N, which being effected, the valve, V, is raised from off the mouth of the tail-pipe, and the water is immediately forced by the atmospheric pressure in the well into the air-vessel, and rises therein until the pressure of the contained air, with the column of water, balances the atmospheric pressure. The pump is now in complete working order, and as fast as the water is drawn from the air-vessel by the pump, fresh water rises up the tail-pipe, O, to take its place, so that the water is kept constantly up to the pump.

Fig. 4.



TURNIP RAISER AND CUTTER.

W. Lister, *Richmond, Yorkshire.—Patent dated March* 14, 1855.

Our engravings, figs. 1 and 2, are respectively a side elevation and a plan of Mr. Lister's new implement for facilitating the removal of turnips and other bulbous roots from the ground. This implement consists of a wrought-iron frame, A, supported at its forward end by a steering wheel, B, and at its hinder end by the running wheels, C. The wheels, C, are mounted loosely on a crank axle, D, which has its bearings in the under side of the frame, A, and is capable of being rocked therein, for the purpose of raising and depressing the frame, as circumstances may require. To this crank axle, D, a hand lever, E, for effecting this rocking movement is firmly secured. F is a curved bar, bolted at its opposite ends to the frame, A, and provided with a row of holes arranged segmentally, to receive a pin or bolt which is projected through the hand lever, for the purpose of retaining the crank axle at a given position. The hind bar of the frame, A, carries a pair of adjustable clamps, G, which are each intended to receive the vertical stem of a horizontal blade or cutter, H. The cutting edges of these blades stand at an acute angle to the line of progress of the implement, in order that they may overcome any obstruction which they may meet, with the greater facility. When the cutters are set at the required distance apart, and at a proper elevation in the clamps, their position therein and on the end bar of the frame, A, is fixed by means of binding screws. The depth of cut is then regulated by raising or depressing the lever, E, and the required relative levels of the blades and the wheels when thus obtained is fixed by passing the pin of the spring lever through the pin-hole in the lever, E, and into that hole in the segmental portion of the bar which is opposite to it. The steering wheel, B, has its bearings in the forked end of a vertical rod, I, which passes through the head of the frame, A, and serves to support it. Affixed to this rod, I, is an arm, K, which is jointed to a hand lever, L, having its fulcrum at M, and extending backwards to the hind end of the frame. By means of this hand lever, the attendant, who walks behind the implement, will be enabled to direct its course with precision while it is being drawn over the field. The fulcrum on which the lever works stands up from the frame, A, to which it is bolted; and a guide, N, which is carried by the bar, F, serves to steady the lever in its horizontal movements. In operating with this implement, the blades are caused to enter the ground at a depth that will just clear the bulk of the turnip, and this level is retained as nearly as possible during the operation of tailing. The action of the implement will be, not only to cut off the tails, but also to raise the bulb slightly out of the ground, and render it unnecessary for the labourer to use any great muscular exertion in gathering up the turnips. It will be understood that this implement may be applied to facilitate the gathering up of mangel-wurzel and other roots, if thought desirable.

Fig. 1.

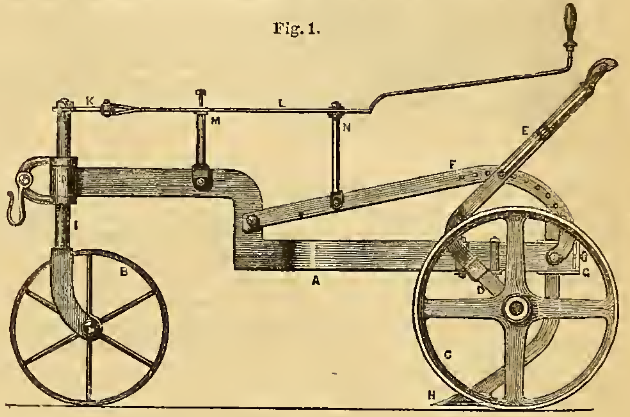
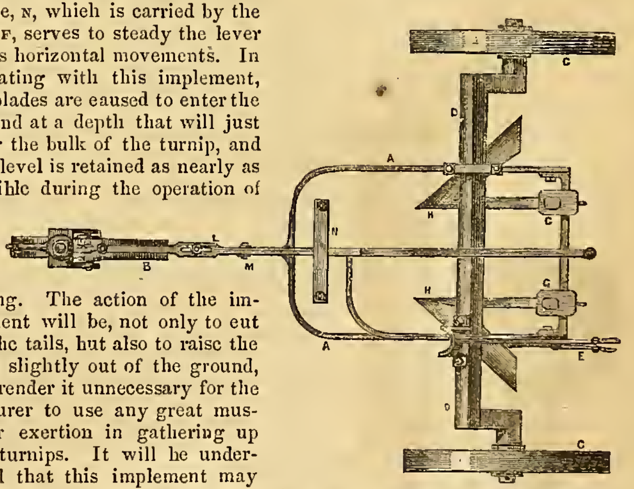


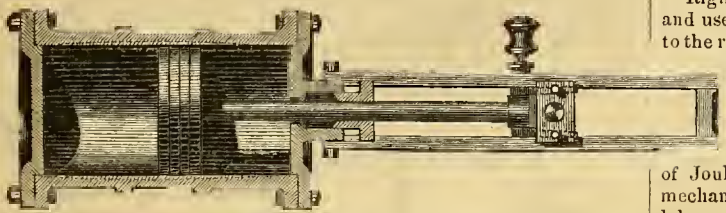
Fig. 2



COMPENSATION FOR WEAR IN MACHINERY, BY RECTILINEAR MOTION.

J. Hughes, *Falcon Engine Works, Loughborough: Patent dated Dec.* 21, 1855.

In locomotive engines, as is well known, the cylinders, after being in use for some time, become worn to a barrel shape internally by the action of the piston. This is owing to the angular action of the connecting rod, which is insufficiently counteracted by the guides, in which the piston rod cross-head works, these guides, or the cross-head slides, becoming gradually worn, and so allowing of play. Several expedients have been tried for compensating for this wear of the slides and guides, but without success, chiefly on account of requiring to be adjusted by a skilled mechanic. Mr. Hughes' compensating contrivance, whilst possessing the requisite efficiency, is extremely simple, and can be easily adjusted at any time by the engineman. Our engraving is a longitudinal vertical section of the steam cylinder of a locomotive, showing the application of the contrivance in question, which consists of a pair of wedges of brass, or other suitable metal, fitted between the cheeks of the cross-head so as to work upon the guides. These wedges are held in position by set screws passed through the cheeks of the cross-head; and, when any play is perceived between the cross-head and guides, the engineman has merely to loosen the set screws, and gently strike up the wedges, subsequently fixing them again in their new position by means of the set screws.



This system of compensating wedges is applicable in all engines, and other machines where wear is produced by surfaces rubbing upon each other with a rectilinear movement, and will be found particularly beneficial in engines, whether locomotive, stationary, or portable, which are driven at quick speeds.

REVIEWS OF NEW BOOKS.

The Combustion of Coal and the Prevention of Smoke, Chemically and Practically Considered. By C. W. Williams. 8vo. Woodcuts. Pp. 244. London: Weale, 1854.

Letter on the Operations of the Smoke Nuisance Act. Same author. Pp. 16. London: Weale, 1856.

The views of Mr. Williams upon the subject of smoke prevention must be well known to the bulk of our readers—so well, indeed, that the present new edition of them really demands no critical discussion at our hands. In the present time of multitudinous combustion theories, and smoke prevention schemes, the best review of the volume which we can give, is to recall the existence of the work to the memories of interested readers, who may thus be enabled to see for themselves the thoughts of an experimentalist author, as developed through something like a quarter of a century.

In his more recent letter, Mr. Williams, in addressing himself to the Sanatory Commissioners of Liverpool, discusses the operation of the Act; the formation and prevention of smoke; and the remedy. As regards the direct effect of the working of the Act, in permanently abating the nuisance, he concludes with reason that it is a failure. The stokers have a bad habit of letting in cold air by their furnace doors, so as to prevent the evolution of dense smoke, knowing, at the same time, that they effectually waste their fuel. It is for the scientific and practical engineer to "look for the principles and means, not merely of abating the nuisance of smoke, but of so constructing boilers and their furnaces, that the process of combustion in them may be so perfect, that the entire gaseous element of the coal (and from which alone smoke is formed) may become available and without smoke."

Useful Information for Engineers: being a Series of Lectures Delivered to the Working Engineers of Yorkshire and Lancashire. By William Fairbairn, F.R.S. Pp. 320. Plates and woodcuts. London: Longmans. 1856.

This useful volume, which brings better notions of common things in engineering, before the great class of mechanical industrialists of this working country, is the best present which the talented author could have made to his operative brethren. It embodies the digested views of a man who has devoted a long and active life to the furtherance of what more than anything else has contributed to render our country great. It is filled with practical matter clothed in practical language, such as tells best in the ears of men more accustomed to deal with the hammer and the chisel, than to listen to pompous declamation, or to pore over volumes of abstruse philosophy.

Some of the matter before us is not new to the readers of this *Journal*, inasmuch as we have already found room for portions of the lectures as delivered.* The subjects run through the series of—construction of boilers; boiler explosions; consumption of fuel and prevention of smoke; economy of fuel and concentration of heat; necessity of incorporating with the practice of the mechanical and industrial arts, a knowledge of practical science; metallic constructions, iron ship-building; and steam and steam boilers.

Rightly judging that an entertaining lecture was the most popular and useful vehicle of instruction for his purpose, Mr. Fairbairn responded to the request of the directors of various northern educational institutions, by distributing the fruits of his experience upon their platforms: and to give permanence to his labours in this way, he has now worked up his matter into a volume, eminently well fitted for the library of the engineer. Going back to the labours of Robinson, Arago, Dalton, and Pambour, and looking into the passing pages of Joule, Thomson, and Regnault, he has enriched his own extensive mechanical resources with all that could add weight and truth to his labours. To the working engineer we say, then, place the volume on your book-shelves.

CORRESPONDENCE.

WORK FOR INVENTORS IN "COMMON THINGS."

I quite agree with your article of last month upon "Work for Inventors," and think that we want much improvement in "common things." If people would only apply what is *already invented* to purposes of a similar nature, we should be progressing onward much faster than we now do.

You mention roads as being very defective, and certainly no truer example could be given. In fact, in winter, the evil is so great that country neighbours see very little of each other, for it is not until the roads get really impassable that highway surveyors think of repairing them, and then the actual carting of repairing materials requires double the amount of horse power sufficient in the summer, whilst the repairing traffic seriously injures the road surfaces. My impression is, that there ought to be a pipe-tile drain under the centre, or on both sides of every road. I have tried this under my own gravel walks, and find it to answer perfectly; you can walk about a drained grass field with great facility even in wet weather, and the day after the rain ceases, it is quite dry. But the roads are far otherwise, and it is quite common to find people trespassing on the adjoining fields, and eventually making a footpath through them, to the great injury of the property, simply to avoid the ditch-faced roads.

After discussing the road question, you not unnaturally come to horse shoes. On this point, I may remark that Stephens, in his *Book of the Farm*, recommends horse-shoe nails to be placed only on one side of the shoe, as I understand the hoof expands in the direction of a line drawn across the foot, or parallel with a line which would connect the two heels of the shoe. It is possible that a hinge in the toe of the shoe would answer the same purpose, but this would greatly increase the cost.†

As to footpaths or trottoirs for towns—flags, tiles, or bricks, laid upon an open substructure of blocks of stone or other material, would probably answer. The material forming the actual footpath surface would be kept high and dry upon the blocks beneath, which would allow of a good ventilating space. For the country, a gravel walk with a tile drain below would be nearly always dry and passable. The plank roads of the United States are constructed somewhat in this manner, and by all accounts they are the best roads in the world for travelling upon, although they would be too expensive in this country.

C. Butler Clough.

Llwyn Offa, Mold, Feb., 1856.

DECIMAL MEASURES FOR MECHANICS.

As the long-talked-of decimal system of weights and measures has not yet been introduced, may I offer you my suggestions respecting it? I propose to retain the existing subdivision, and instead of altering the minor parts, I would transform the present eighths of an inch into tenths, ten of these tenths making one inch, and ten of these a foot. The foot would be increased in length by four eighths, or half the present inch.

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* Pages 94 and 115, Vol. IV.; and 75, Vol. VI., *P. M. Journal.*

† A hinged shoe still more comprehensive has lately been proposed. We shall supply full details of it when duly matured.

Most calculations in mechanical matters are based upon the inches, and I think that were it intended to alter it otherwise, there would be a good deal of opposition. It would greatly simplify all calculations, and economize time immensely. Were my plan adopted, the present system of screw tackle and subdivisions of the inch, now sixteenths, would be twentieths, causing no extra expense or trouble. The foot measurement could be more easily altered than any other, as a very slight inconvenience would arise here; and there would be no difficulty should old measurement be given at any time instead of new.

EXETER.

February, 1856.

SCREW-PROPELLER ENGINES.

In the January part of the *Practical Mechanic's Journal*, I find two designs for screw-propeller engines, and as I am interested in this subject, I shall be glad if you will accept the following remarks thereon. As regards Messrs. Blackwood & Gordon's engine, with three cylinders carried by a rotating plate, the idea is not new; for I have seen a model of two cylinders revolving, as far back as twenty years since. I am not the less surprised, however, to find such a scheme now brought forward for practical purposes.

The *eccentric* arrangement for working the valves is wrong, for instead of the pin, as shown in the engraving, connecting each valve-rod to the eccentric ring, each rod might as well be keyed in a socket, which is manifestly impracticable; nor would it answer to connect each valve-rod by means of a link to the strap, but one valve-rod connected to the strap in the usual way, and the others by links, would answer so far as the confined arrangement would allow; but no three valves can be properly worked by short rods from one eccentric. The cylinders have certainly short connecting-rods and no piston-rods, but a great deal too many glands to be looked to, and all those about the trunks and valve-rods cannot be touched whilst the cylinders are in motion; nor can I see any means of lubricating the joints in the trunks. There must be serious friction in such an engine, and there appears to me to be many practical objections to prevent its coming into general use.

The other scheme by Mr. Morrison is rather more ship-shape, but even it is very objectionable, for there is all the complication of the double cylinder engine, without any of its advantages. It is only a balanced engine at a certain pressure, and there is the decided practical objection of a stuffing-box between the two cylinders, which might lead steam into the condenser; besides this, the stuffing-box is inaccessible. Why not lay the cylinders on their sides, and balance the connecting-rods by a disc, as Bourne does, and thus dispense with the extra cylinder and appendages, reducing the cost by one-third, whilst all the parts would be free of access?

N. D.

London, *February*, 1856.

[If our correspondent will refer again to our description of Messrs. Blackwood & Gordon's engines, he will find that the valve-rods are not all three jointed to one eccentric ring, but are each worked by a separate ring loose on the eccentric; an arrangement which we have seen in actual operation. We believe it was never intended to adopt these engines for any but small sizes, in which the objections mentioned by our correspondent, if they exist at all, are not of such moment as in larger engines.

As to Morrison's engines, where the saving of space is desirable, this class is generally adopted. The space taken up in height is unimportant, as the engines must have a clear opening above them in any case. In horizontal-cylinder engines, as ordinarily arranged with the cylinders across the vessel, a very great width is taken up, as compared with that occupied by what have been not inappropriately termed "steam-hammer" engines, of which class are Mr. Morrison's.—*Ed. P. M. J.*]

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

NOVEMBER 27.

"Description of an improved form of Safety Valve for Steam Boilers," by Mr. J. Fenton.—The object of this valve was the prevention of accidents, arising from the liability of the ordinary mushroom-shaped safety-valves to stick fast; this was effected by making the valve spherical, with a hemispherical seat and a hemispherical cup bearing upon the ball valve; this cup was connected to the valve lever by a spherical joint; all the other joints of the lever and attachments being also on the ball-and-socket construction, so that all were free to move in any direction, and no sticking of any part was possible. A model of the single valve, and diagrams of both single and double valves were exhibited; the latter were so arranged with a single lever, as to act as a lock-up valve and an open valve combined, both being equally limited to the maximum pressure of the lock-up spring. A considerable number of these valves had been in use for some time with decided success; they afforded a considerably greater security than the ordinary safety-valves, without greater expense of construction, and it was anticipated that they would be more durable than the ordinary valves, and be quite as easily repaired and kept in order.

In a recent letter to Mr. Kirtley, it was stated by Mr. Baillie, that eighty-one engines on the Hungarian and Austrian lines were carried upon volute springs, and it was intended to alter all the others as opportunity offered. Double springs had been generally used for the middle bearing, but it was not now considered necessary, as some engines with single springs appeared to be quite as steady, and not to receive greater shocks than the others. The great point to be attended to was, that the volutes should not be overloaded, nor be screwed down too tightly. A volute of steel 5¼ inches broad and $\frac{7}{32}$ inch thick, should not be loaded with more than 20 cwts., nor one of 4¼ inches broad and $\frac{7}{32}$ inch thick with more than 15 cwt., and it would be still better if their loads were reduced to 18 cwt. and 13½ cwt. respectively.

Great attention should be paid to the due and proportionate loading of the springs under an engine, and the engine-driver should be strictly prohibited from altering the position of the nuts on the holding bolts of the springs, as, besides altering the volutes, an undue weight must be thrown upon the other axles, and damage would ensue to the machine as well as to the rails.

With the ordinary flat springs, it was difficult to ascertain exactly what pressure was put upon them by altering the screws; but with the volutes a certain law obtained, which rendered evident the absolute pressure to which they were subjected. Each spring was depressed a certain distance by a given weight, say, for instance, those of certain dimensions would be depressed ¼ inch by 6 cwt.; so that, if the spring was originally 8¼ inches high when unloaded, it would, under a weight of 18 cwt., have been reduced to 7½ inches in height; then, by trying and marking the trial weights upon the volutes, and regulating them accordingly, there could not be any error in computing the pressure upon them.

The weighbridge for ascertaining the exact weight upon each wheel had been generally adopted with good effect, and to prevent the enginemen from altering the weight upon the springs, some thin washers were placed between the cross-bar and the collar upon each holding bolt, which precluded the possibility of tampering with it. The effect of this regulation had been, that the engine-springs rarely required to be meddled with, and very few fractures occurred, unless the railway was in a bad state.

The reason for employing such heavy engines for the conveyance of passengers was, that there was only one train of that kind per day, and one mixed train of passengers and goods at night; the former weighing about 160 to 180 tons, and running at a speed of 30 miles an hour, and the mixed train weighing from 250 to 270 tons, travelling 24 miles per hour. The bulk of the traffic consisted of goods, of which from 60 to 70,000 tons were conveyed per month, along the railway from Szegedin and Szolnok to Vienna, a distance of 304 English miles, which length it was intended to extend to Weiskirchen, about 140 miles further to the south-east of Szegedin.

An illustration was given of the adaptation of the volute springs to hydraulic safety-valves for equalizing the pressure on water-mains, and obviating the injurious effects of the concussion caused by the oscillation of the column of water. This system, which had been introduced by Mr. Croker, for the Amsterdam Water Works, was easily adjusted to a head of 170 feet, representing a pressure of 39·2 lbs. per square inch, or a total load of 1,970 lbs. on the valve; it had been in use for six months, and might be perfectly relied upon.

The arrangement was very simple, consisting merely of a vertical branch of 8 inches diameter springing from the horizontal main pipe of 6 inches diameter; on the top of the branch pipe was fixed a valve and seat of gun-metal, so arranged, that upon the lugs were fixed the wrought-iron bolts holding the cross-bar, between the under side of which and the top of the valve was placed a volute spring of about 2½ tons pressure; the exact pressure was regulated by adjusting bolts provided with stop-nuts, and the apparatus could be accommodated to the required head with great facility and precision.

Drawings were exhibited of the "Wien-Raab" locomotive engine, constructed by Mr. John Haswell, locomotive superintendent of the Vienna and Raab Railway, and sent to the Exhibition of Industry at Paris in 1855. The chief characteristics of this engine, which was intended principally for the goods traffic, were its having outside cylinders, inside framing, and eight wheels, all coupled. As the distance between the axles of the leading and the trailing wheels was 12 feet, it was necessary to have special arrangements for enabling this great length to pass curves of short radius; this was accomplished by allowing the bearings of the trailing axle and its coupling rods to have a lateral motion of 18 lines, and in the trials upon the Sömmering inclines of 1 in 40, it was found that this engine would draw up a load of about 110 tons at an average speed of nearly 12 miles per hour, passing with facility round curves of as small a radius as 600 feet; the motion of the engine being much steadier than that of any others of the same power. When evaporating 200 cubic feet of water per hour, the engine could draw, on a level, a load of 1,047 tons at a speed of about 14½ miles per hour.

The engine, with the water in the boiler, weighed 34 tons, and the division was so arranged, that no wheel pressed with more than 4·4 tons weight upon the rails;—a great superiority over other engines tried upon the line, as in some cases the weight was as much as seven tons upon one wheel, which would suffice to destroy the heaviest rails; and the ultimate effect was, that when the permanent way became uneven, the jerks were so severe, that the springs could not prevent them being seriously felt by the engine, the structure of which was soon dislocated.

The fire-box was arranged for burning wood or turf, but with a trifling modification could be adapted for coal or coke, and the spark-catcher was like that of the American engines.

All the chief working parts were so placed as to be fully in sight, and were easily accessible for examination, for oiling, and for repair. This desirable end was attained by employing the space within the frames formerly, and in other engines, occupied by the pumps and slides. The frames were firmly connected together by strong transverse stays, offering great resistance to lateral strain, and at the same time rendering the frame much stronger, with less weight of material, whilst the opposite axle-boxes were as firmly connected together as if they were formed out of one piece of metal.

The guides for preventing the lateral oscillation of the wheels and axles, were placed in the centre between the axle-boxes; and between the side plates was a guide-block, working upon a pin, on the same level as the axle traversing the guides. By this arrangement it became possible for one wheel to rise or fall, without the frame of the engine being strained.

The volute springs which were used for bearing the weight of the engine were placed withinside the frame, and, in consequence of the arrangements already described, could be fixed considerably lower than the ordinary flat springs; thus obtaining the great advantage of lowering the centre of gravity.

The centre guard was omitted for the hinder or sliding axle, and in order that the springs might not interfere with the requisite lateral motion, the lower ends of the bolts, by whose upper ends the engine was suspended upon the springs, were allowed to turn with the play of the axle.

The wheels were cast-iron discs, with cast-steel tyres.

The boiler was of the ordinary construction, and had adapted to it a safety-valve with a large aperture, held down by the volute springs, by which any accumulation of pressure of steam beyond 8-10ths of an atmosphere above the maximum working pressure was effectually prevented. In practice this had been found to offer an effectual protection against accidents arising from carelessness or daring, and the system was now adopted for all the engines on the railway.

DECEMBER 4.

"On the Vertical Structure of the Primary Rocks, and the general character of their Gold-bearing Varieties," by Mr. E. Hopkins.

DECEMBER 11.

Discussion on Mr. Hopkins' paper.

DECEMBER 18.

This was the annual general meeting, when the report of the Council for the past session was read.

MONTHLY NOTES.

Spiral-Coil Piston Packing.—In the days of the huge hemp-packed pistons, a very middling degree of steam-tightness was obtained at the expense of enormous and irregular friction; and even now, with the improved metallic packing, serious frictional loss arises from the intensity of the dead-spring pressure which is usually put on to insure a fair working fit. To reduce this loss as far as possible, Mr. Joy of Worcester uses the packing metal in that form which will produce the greatest amount of continuous elasticity, the fitting spring being made to act through a lengthened space, with a comparatively slight intensity of pressure. Our engravings represent a piston packed in this way, as in external elevation and transverse section. The body of the piston is a plain block, into which the rod is screwed and pinned. This block is turned to a diameter 1-16th inch less than that of the cylinder's bore, and a recess is then cut round it with a $\frac{1}{2}$ inch tool, set at $\frac{1}{2}$ inch pitch, the cut extending to three inches more than two revolutions of the piston. The packing is made out of a cast-iron or brass ring, $\frac{5}{8}$ inch thick, and $\frac{3}{4}$ inch larger in diameter than the cylinder. This ring is turned and bored, and being placed on a mandril, a spiral groove is cut in it with a $\frac{1}{8}$ inch tool, set at $\frac{5}{8}$ inch pitch. This cut, when carried through, leaves the ring in the form of a spiral coil of $\frac{1}{2}$ inch by $\frac{5}{8}$ inch section, and of about five full revolutions. A portion of this spiral is cut off, equal to two revolutions and $\frac{3}{4}$ inch over; and this is threaded on the piston block, and pushed down until it drops into the turned-out recess, which it exactly fills laterally. A sheet-iron screw cramp is then placed round the packing, so as to compress the latter to the diameter of the piston, which is then placed at the mouth of the cylinder, the ports being protected by small blocks of wood, and the piston is then passed from the cramp into the cylinder. A packing of this kind avoids friction, by securing an elasticity as light as possible, but yet sufficient to produce perfect contact with the cylinder.

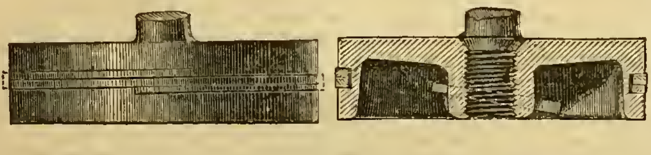


Fig. 1.

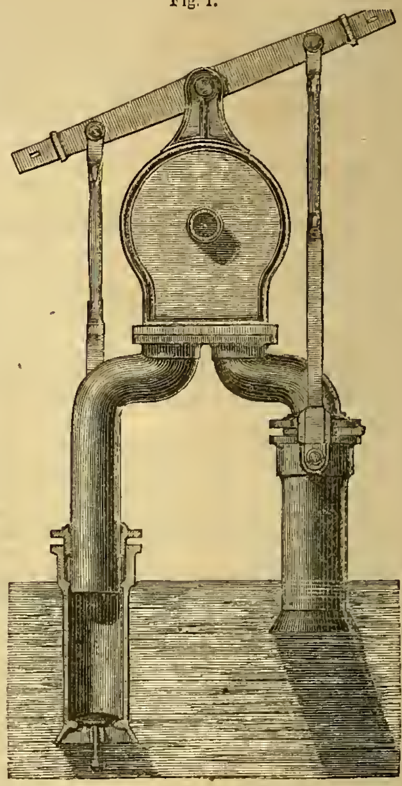
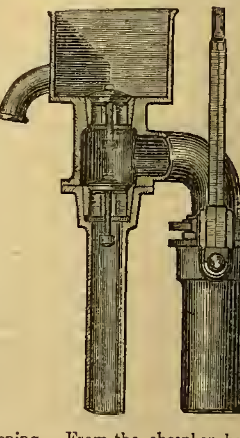
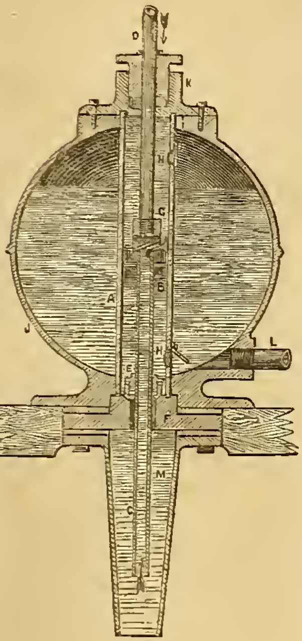


Fig. 2.



Clunes' Traversing-Barrel Pump—American Duplex-Action Pump.—Mr. Thomas Clunes of Aberdeen, whose clever rotatory pump we published some years ago, has proposed the adoption of traversing barrels, in pumps of reciprocatory action, so as, in effect, to do away with pistons or buckets proper. Our engraving, fig. 1, represents Mr. Clunes' idea as developed for the purposes of a fire-engine. It consists of the usual double-handed lever, set to oscillate upon its longitudinal centre on a fixed stud-pin, carried by a pedestal bracket, on the top of an air vessel, resting on a stationary base flange. To this base is bolted the flange of a pair of curved water-way pipes, which descend by a curved divergence to the level of the fluid to be raised, and forced out through the air vessel. The upper end of each pipe is guarded by a clack valve, opening upwards in the interior of the air vessel. The lower portion of each pipe is vertical, and is turned true for the working action of the pump cylinder. This pump cylinder is made, in its general features, like an ordinary pump barrel. It is closed at its lower end, where a clack valve is inserted, for the admission of the fluid to be pumped. Its upper part is fitted with a wide stuffing-box, made to fit accurately to the turned portion of the water-way pipe, over the open lower end of which it is entered, to work perfectly fluid-tight. From the overhead working lever, a forked pendant rod, jointed to the lever, descends to joint-stud pins in the working cylinder. The same details are fitted up on each side of the air-vessel centre. Then, as the lever is worked up and down, the pump cylinders are alternately traversed over the lower ends of the water-way pipes as guides; and the cylinders being immersed in the fluid to be lifted, the fluid enters the valved bottom of the cylinder at each down-stroke of the latter. Then, at the succeeding up-stroke, the fluid in the cylinder is expelled upwards through the open water-way; the cylinder foot valve closing, whilst the head or delivery valve in the base of the air chamber opens upwards, to allow the fluid to enter the air vessel. The air vessel acts in the ordinary manner for securing a continuous stream of fluid; and it is fitted with a discharge pipe, for the final expulsion of the fluid in the usual way. In another modification—see fig. 2—better suited as a ship's pump, the details of the traversing cylinder are similarly arranged, except that the bottom end of the cylinder is perfectly solid or closed, the fluid to be raised being caused to descend into, and then ascend from, the water-way pipe and working cylinder from the upper part. The upper curved end of the water-way pipe terminates in a valved chamber at the base of the upper receiver, into which the fluid is to be delivered. The upper opening of the water-way pipe is situated between two clack valves, both opening upwards, one clear above, and the other clear below, the water-way opening. From the chamber beneath the lower valve, a stationary suction or lift pipe descends to the fluid to be raised. The traversing pump cylinder may be worked in any convenient manner, and as it descends, it tends to cause a vacuum in the suction pipe and in the main water-way pipe; so that the fluid to be raised obviously flows upwards, and fills these parts, as well as the working cylinder. As the latter again rises, it then forces the fluid up through the water-way pipe, and through the valved chamber, into the overhead receiver. Fig. 3 is a vertical section of a double-action pump, recently adopted in America. It is the invention of Mr. Joslyn of Worcester, who has here attempted to improve upon the ordinary contrivances of the kind, by getting a straight flow to and from the working barrel. The barrel, A, is a plain tube of

Fig 3.



brass, maintained in its proper vertical position by the top and bottom of the air vessel, J. The top of the barrel fits into an annular groove in the cover, K, and the bottom in a similar groove cut for the purpose in the flanged valve seat, F. The yielding substance of the packing, used in attaching both cover and seat to the air vessel, J, allows the barrel, A, to be bound tight between the two. At B is the pump piston, composed of two metal discs, with leather packing between, and turned up on their edges in the usual manner. Into the bucket is screwed the suction tube, C, above the orifice of which, and on the top of the bucket, is a valve opening upwards. The tube, C, is carried down so far that its end may, as the pump operates, be always submerged in the reservoir below. D is the pump rod, connected to the bucket, B, by the arched piece, G, which is of such a form as to allow the valve on the bucket to work freely. The rod passes through the stuffing-box on the cover, K, and is connected above to any suitable handle, or other convenient driving apparatus. E is a valve composed of two pieces, one screwed into the other, with a light packing substance between; and through this valve passes the tube, C, easily enough to allow the valve to work with freedom, the packing at the same time preventing any leakage. The valve, E, is prevented from rising too high by projections on the inside of the barrel, and the tube, C, is guided by a guard under the seat, F. The barrel is furnished with upper and lower discharge valves, H, and the air vessel with the discharge pipe, L. M is the main suction pipe, with flanges on the top to secure it to the under side of the air vessel, the same fastening serving for the valve seat, F. On the descent of the bucket, B, as shown in our figure, the suction valve, E, and upper discharge valve, H, are closed, and the water in the barrel below the piston is forced through to the lower discharge valve into the air vessel, and through the pipe, L, to its destination. At the same time the water from the reservoir rises in the tube, C, passes through the bucket valve, and fills the space above. On the upward motion of the bucket, the lower discharge valve, H, is closed, and the valve, E, opened; while the bucket valve being closed, and the upper discharge valve open, the water above the bucket is forced through the latter into the air vessel; and through the pipe, L, at the same time, a fresh supply of water is admitted through the main suction pipe, M, and valve, E, to the space below the bucket, preparatory to being again discharged on the descent of the piston.

CHATTAWAY'S CENTRAL RAILWAY BUFFING AND DRAWING APPARATUS,—The practical working of this ingenious and useful contrivance enables us now to follow up our elaborately illustrated article * upon it with a comparative statement, showing the saving which it effects in cost and deadweight:—

	Cost.				Weight.		
	£	s.	d.		cwt.	qrs.	lbs.
No. 1.—Baillie's patent Y 2 buffers, with volute springs, drawhooks, couplings, and side chains, - - - - - -	10	18	0	...	8	1	0
No. 2.—Brown's patent buffers, with conical springs, drawhooks, &c. &c., as above, -	11	8	0	...	7	3	0
No. 3.—Laminated buffing springs, with buffer rods, drawhooks, &c. &c., as above, - -	10	18	0	...	10	0	8
No. 4. — Chattaway's patent buffing and coupling apparatus, - - - -	6	6	0	...	3	2	0
Saving of the latter as compared with No. 1,	4	12	0	...	4	3	0
Do. do. No. 2, -	5	2	0	...	4	1	0
Do. do. No. 3, -	4	12	0	...	6	2	8
Average saving in money and deadweight, -	4	15	4	...	5	0	21

MARINE MEMORANDA.—PROGRESS OF SCREW-PROPULSION.—The unfortunate accident to Mr. Patterson's fine steamer, the *Demerara*, on leaving Bristol, fresh from the stocks, to fetch her engines from the Clyde, will be well remembered as a curious example of the casualties to which marine works are liable. In going down the river, she swung round and went ashore, under such circumstances that her owners and builder decided that she could not possibly be repaired. Somehow, however, she has now come out as a 3200 ton sailing-ship, bringing home 4500 tons of guano, at a freight of £5 a ton. Her altered fortunes arose thus:—When given up to the underwriters, Messrs. J. & R. Wilson of Liverpool surveyed her, and thinking that repair was possible, they purchased her for £7000, about one-tenth of the cost of building such a hull. The attempt was accordingly made, and she was fitted out at Bristol, and sailed last spring in ballast for the Chinchas, going there in 120 days. She is now in the Thames with her splendid cargo, and hails as the *British Empire*. She draws 22½ feet of water, and has repeatedly made 17 knots an hour. Such is the result of an apparently very hopeless case. The General Screw Steam Shipping Company has made an enormous wholesale disposal of its steamers to the French government. By one single transaction, the *Jason*, *Indiana*, *Golden Fleece*, *Calcutta*, *Argo*, *Queen of the South*, *Hydaspes*, and *Lady Jocelyn*, have become the property of our French neighbours, at the cost of nearly £500,000. This is the largest purchase of shipping ever made in one line. It was effected by Mr. Graham, of the firm of Maitland, Cuthbert, & Co., of Paris; Mr. Brett, of the firm of Cunard, Brett, & Austen, of London; and M. Beraud Villars, manager of the French Clipper Company.

AMERICAN MACHINERY OF THE FARM.—The straw-cutter, represented in perspective in fig. 1 of our annexed illustrations, has been introduced in America by a Mr. Seeley of Albany. Its essential peculiarity is involved in the cutting-knife, the face of which is formed differentially, as in the detail, fig. 2. This knife has a central point, which enters the bundle of straw under treatment at the centre, where it naturally bulges up into a hard mass, rendering the task of severance much easier than with the plain straight edge. The four inclines constituting the cutting edge, combine to act with a shearing effect, and its power of cutting is so great that it passes right through sticks or other foreign bodies accidentally getting into the straw. The machine is driven by a winch upon an upper cross shaft, carrying a spur-wheel in gear with a pinion on the fly-wheel shaft. The latter shaft is cranked at its centre, and a connecting-rod passes down to a double lever in the framing. From the opposite end of this lever, a rod passes upwards to the knife frame, the cut being downwards over a square iron edge. The straw is drawn forward by a pair of grooved rollers, driven by a ratchet movement from the main gearing.

Fig. 1.

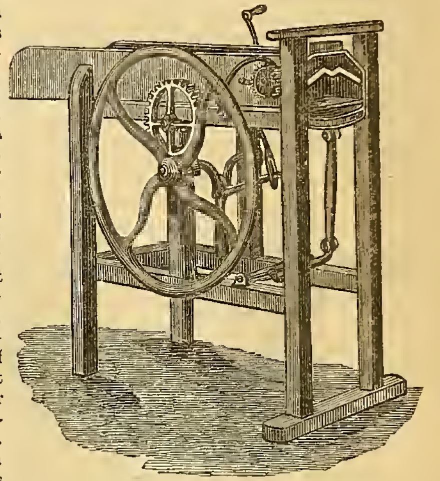
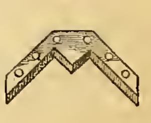
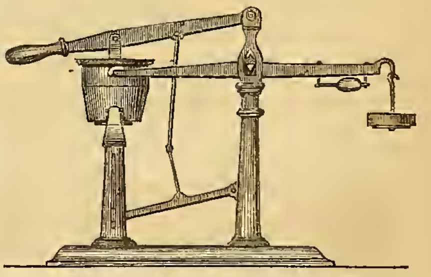


Fig. 2.



America has been eminently prolific in churns, and having approached pretty nearly to perfection under this head, inventors have gone a little further in devising a means of rapidly weighing and stamping butter for the market. Our third figure represents a contrivance for producing finished pounds of butter ready for the dealer. It consists of a weighing or balance beam, carrying a weight adjustment at one end, and a butter mould at the other. The mould end of the beam is forked, so as to embrace the mould, which has lugs resting on the fork. On each side and towards the bottom of the cup are other two lugs, between which are projections from the forked ends of a second column. The latter is hollow for receiving a vertical spindle, on the top of which is a disc, the bottom being connected to a lever which has its fulcrum on the main column. Immediately above the centre of the beam, and on the top of a continuation of the main column, is the swivel joint of the stamping lever, which is arranged to turn laterally at pleasure. The end of the lever is furnished with a handle for the operator, and immediately above the cup or mould with a jointed rod, having on its end a disc, to which is secured the wooden stamp carved with the device required. The stamping and lower levers are connected together by a light chain or jointed rod, and the cup is furnished with a false bottom, which, together with the inside of the cup, is enamelled. The stamping lever with its disc removed from the cup is, by means of the swivel joint, removed on one side, and the butter placed in the cup, to the requisite amount indicated by the sinking of the same, as far as the lugs and projections on the forked column will allow. The stamping lever is now turned until the disc coincides with the cup, and is then brought down, so that the disc may stamp and compress the butter, which assumes a form similar to that of the cup. The lever is now raised nearly perpendicular, giving through the connecting chain a movement to the lower lever, which raises the perpendicular rod in the column, and causes its disc to elevate the false bottom, and with it the butter above the top of the cup, from whence it may be easily removed.

Fig. 3.



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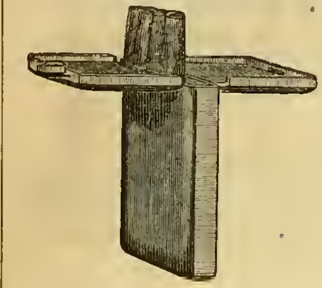
* Page 175, *ante*.

French Literature.—The progress of literature in France has just been statistically developed by the *Journal de la Librairie*, in publishing an account of the literary and artistical works issued during the last forty-four years. From 1st November, 1811, to 31st December, 1855, inclusively, that is to say, in forty-four years and two months, there were published in French books, Latin and Greek classics, and in foreign languages, 271,994 works on different subjects; 47,125 engravings, drawings, lithographic prints, &c.; and 17,449 musical works, making together a total of 336,868 publications. The year 1855 of itself produced 8,235 works in French classics and foreign languages, 1,105 musical works, and 2,857 engravings, lithographic and photographic prints, making a total of 12,197 publications. The year 1855, as regards books, has been the most prolific of the whole forty-four years.

Mauchline Portable Cases.—The celebrated "Snuff-box Works" of the Messrs. Smith at Mauchline, in Ayrshire, may well be cited in illustration of what energy and perseverance will accomplish in producing an important trade out of trivialities. As treated at the Mauchline Works, the snuff-box, and a few kindred elegancies, involve all the dignity and magnitude of the factory system, large numbers of hands, of all grades, being there employed in producing, on the large scale, the beautifully-hinged wooden boxes, which are almost marvellous for their accuracy of fitting and peculiar suitability of purpose. The little article which we now engrave in perspective is a new production at these works. It is a case, or holding receptacle, for cards, cigars, and other articles, and possesses the double advantage of perfect security when closed, and great facility of opening and closing, whilst the contained articles are most completely exposed when wanted. Cigar cases made on this principle present the ordinary flat-pocket-case shape, and the greater portion of the length of the case—say two-thirds or three-fourths—is solid, whilst the remainder is bivalved, or formed with two separate doors, hinged one on each side to the body of the case, for the admission and extraction of the cigars. The line of junction of the two hinged opening pieces is in the plane of the case, being either quite in the centre of the case's thickness, or more or less to one side. The central junction is preferred, inasmuch as it gives the same thickness and weight to each door, or opening piece. The two hinged doors are held together, when the case is closed, by an end-embracing catch of any convenient kind, as the ordinary French clip, for example. When this fastening catch is thrown back, one or both of the hinged doors may be turned over to a right angle with the plane of the case, so as to expose the upper ends of the cigars all round in a most complete manner. The cigars may thus be examined, and individual ones selected, with great facility and certainty. The same general arrangement is applicable to spectacle cases, as it enables the user to fully expose the upper end of the spectacles with great facility. Visiting or commercial card and pattern cases may be similarly made; also razor cases, and many other receptacles for small articles of different kinds.



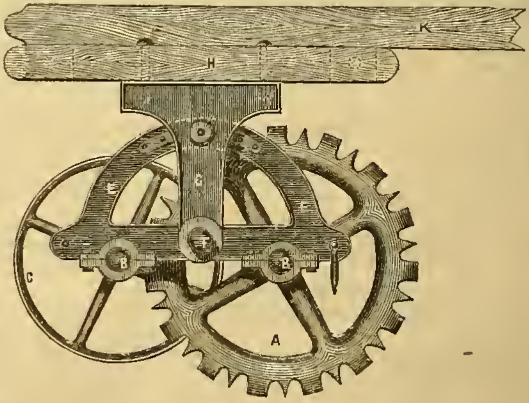
Floating Steam Bridge to the Isle of Wight.—The time-distance from London to Ryde, in the Isle of Wight, is at present four and a half hours, but this appears to be much too slow a system of communication for our hurrying times, and it is now intended to bridge over the space between the two coasts by a "Floating Steam Bridge." In doing this, a short extension railway is to be made from Gosport to Stokes Bay, off Anglesea, and a pier will here be run out into deep water to accommodate steamers in all tides. By this plan the present charge of conveyance between the Gosport and Portsmouth Railway stations and the steamers will be avoided. Between this pier and Ryde a floating bridge is to traverse a distance of three miles (instead of the present route between Gosport and Ryde of five miles and a half) in about twenty minutes, at half-hour intervals, with passengers, goods, and cattle, so as to work in with the London trains. Facilities are to be given to enable horses and carts or waggons to drive on and off the floating bridge by means of a moveable stage, which will land and embark them at all times of tide at the Ryde esplanade. The proposed capital is £20,000. A line of steamers is also in view between Stokes Bay pier and Havre, reducing the time between London and Havre by two hours, and cutting off eighteen miles of the sea passage.

Mechanic's Institution Class Examination at the Society of Arts.—The Council of the Society of Arts propose to hold, at their house in the Adelphi, an examination of candidates from classes of mechanics' institutions during the week commencing the 9th of June next. The subjects of examination will be mathematics, mechanics, chemistry, physiology, botany, geography, English history, English composition, the Latin, French, and German languages. The following are the names of the examiners:—The Astronomer-Royal Dr. Bernays, the Hon. and Rev. S. Best, the Rev. Dr. Booth, F.R.S., the Rev. Professor J. S. Brewer, Mr. C. Brooke, F.R.S., the Rev. Professor W. Browne, Dr. Carpenter, F.R.S., Mr. Harry Chester, the Rev. S. Clark, the Dean of Christchurch, Oxford, Viscount Ebrington, M.P., the Rev. Dr. Elder, Mr. J. Glaisher, F.R.S., the Dean of Hereford, Mr. R. Hunt, F.R.S., Dr. Bence Jones, F.R.S., Professor Moseley, F.R.S., the Rev. Bath Power, Mr. F. R. Sandford, Mr. J. Simon, F.R.S., Professor E. Solly, F.R.S., the Rev. F. Temple, the Rev. Dr. C. J. Vaughan, Dr. Watson, Professor John Wilson, F.R.S.E.

Metford's Theodolite.—Mr. King, jun., of Bristol, has made for the inventor, Mr. Metford, an improved theodolite, which offers several advantages for the convenience of the engineer. The most important of these are a traversing stage, and a curved arm upholding the transit axis. The stage is so constructed, that the whole instrument can be moved in any direction one inch from the centre, and the curved arm is so attached to the main centre as to allow of a transit motion, thus making this theodolite equal to an altitude and azimuth instrument. This substitution of a curved arm for the heavy works at present generally employed, entirely prevents the usual top-heaviness, and greatly reduces the total weight. After six years' use, the instrument has been found to work and wear perfectly steady and well. The horizontal limb holds a circular level, compass, and memorandum slates, and the transit telescope can be used through it for very depressed angles. The limbs are divided in a simple way, to read to decimals, either of degrees or minutes, as well as to seconds. The construction of the pivots gives great stability, on account of their having the broad bearing flanges usual in levels, and the addition of the rectangular eye-piece enables the observer to remain in one position for all observations, and is useful in tunnelling. There are, also, improvements in the levelling apparatus—in attaching the transit telescope to its axis—in the construction of the diaphrams—in the long level—in the check telescope—in the setting of the object-glasses in their cells, to facilitate their being cleaned—in lighting the wires, and in fixing the instrument in its box. The small weight of the instrument, compared with its power—its capability of horizontal motion—its great steadiness in use—the balance of the optical work to the power of the limbs—the great range of the vertical circle, it being 320°—the addition of the circular level, and the many minor improvements, combined with its compact and graceful appearance, are worth attention.

Continental Gunnery.—War finds out defects in our routine systems, overlooked or uncared for in time of peace, just as the rains of heaven find their way through a roof which keeps up its credit during fair weather and sunshine. The Russian war certainly discovered many chinks in our offensive and defensive practice, and it will be well if the lesson is considered and remembered. When our shortcomings could be no longer disregarded, a Government commission was despatched to the continent to see what instruction could be gleaned from our scientific neighbours. The commission visited Liège, Seraing, Clermont on the Meuse, Namur, and Charleroi in Belgium; Spardau in Prussia, Munich, Strasbourg, Paris, and Rucelle were also looked in upon; and the result is a most interesting "Report on the State of the Manufacture of Iron and Brass Ordnance in various Continental States." In tools, and the general mechanical arrangements, this report shows us that we can afford to teach; but as far as careful attention to well-digested principles, and the practical application of scientific refinements, we must be satisfied with being taught many good things. Some of these we shall notice hereafter.

Utting's Combined Adjustable Clod Crusher and Land Roller.—The introduction of this instrument marks another step in the construction of land-tilling mechanism. Our engraving is a side elevation of the apparatus with the traction shafts broken away, and as looking on the ends of the axles. Two sets of rollers or wheels are used, one set, A, having sharp circumferential edges for cutting or dividing the clods, being made either plain or serrated. The form shown in the figure is, however, preferred, consisting of teeth placed with their broad points alternately at right angles to each other. These rings or wheels, A, work freely on the spindle, B, and are made to work in the intervening spaces between a second series of cast-iron rings or wheels, C, which are made with flat peripheries, for the purpose of still further pulverizing and levelling the soil, as well as to prevent the cutting edges from sinking too deeply into the ground. These latter rings or wheels work freely on the spindle, D. The two spindles, B and D, are carried by the semicircular frames, E, which turn freely on centres at F in the brackets, G, which are bolted to the under side of the main framing, H, of the implement. These moveable semicircular frames, E, have a number of holes formed in them at J, and the fixed brackets, G, have a single hole made in them, corresponding to the holes in the moveable frames. In order to adjust the relative position of the two sets of rings or wheels, A and C, to the surface of the ground, it is simply necessary to raise or lower the shafts, K, and insert suitable regulating pins into the proper holes required. By raising or lowering the main shafts of the implement, and inserting the regulating pins in the proper holes, the relative positions of the two sets of rings or wheels may be altered; that is to say, either the sharp cutting rings, A, alone may be brought in contact with the ground, or they may be elevated therefrom, and the flat-edged rings, C, brought into action only; or they may both be brought into contact with the ground together, when the action of the implement will be twofold; as it will first break or cut the clods by the aid of the sharp rings, A, and then further reduce them and level them by the



action of the flat-edged rings, c, which also serve to keep the cutting rings clean from dirt (one set of rings cleaning the other), and preventing them from penetrating too deeply into the ground. When used as a clod-crusher only, the two sets of rings may be so adjusted as to cause the front or sharp-edged rings to act with more than double their own weight. When it is desired to use the implement as a roller for wheat or pasture lands, travelling wheels may be attached, so that it will run entirely upon the flat rings.

The British Association at Cheltenham, 1856.—The Cheltenham meeting of the British Association has been fixed for August 6. The following gentlemen have accepted the several secretaryships of the sections:—Section A. Mathematics and Physics: Rev. T. A. Southwood, M.A., head master, civil and military department, Cheltenham College; Rev. J. C. Turnbull, M.A., head mathematical master, Cheltenham College. B. Chemical Science: Professor Voelker, Royal Agricultural College, Cirencester; J. Horsley. C. Geology: T. Wright, M.D., F.R.S.E.; J. Scougall, F.E.J.S., M.C., P., master, modern department, Cheltenham Grammar School. D. Zoology and Botany: Professor Buckman, F.G.S., &c., Royal Agricultural College, Cirencester; J. Abercrombie, M.D. E. Geography and Ethnology: F. D. Hartland, F.S.A., F.R.G.S.; H. W. Ramsay, F.R.C.S. F. Statistics: Rev. C. H. Bromby, M.A., Principal, Church of England Training Schools; N. M. Tartt, F.S.A. G. Mechanical Science: H. M. Jeffreys, M.A., mathematical master, Cheltenham Grammar School; B. Jones, jun., Esq.

The Railway Service of Great Britain.—Most of us can go back to the times when railways were great curiosities, when they were luxuries and not necessaries of life. This is not very long ago; and it is somewhat difficult to assure ourselves of the enormously exuberant growth of the system during the few years which have elapsed since the date alluded to. But the statistics of the service bring the facts home to us, as the following statement explains:—It appears that on the 30th of June, 1855, the following persons were employed on the railways of the United Kingdom then open for traffic—viz., 204 secretaries and managers, 33 treasurers, 140 engineers, 356 superintendents, 193 storekeepers, 181 accountants and cashiers, 823 inspectors or timekeepers, 2,183 masters of stations, 322 ticket collectors, 153 draughtsmen, 7,732 clerks, 1,132 foremen, 3,157 engine drivers, 3,488 deputy drivers or firemen, 3,237 guards or breaksmen, 21,247 artificers, 2,836 switchmen, 2,470 gatekeepers, 1,622 policemen, 14,498 porters, 7,172 platelayers, 22,449 labourers, and 2,324 miscellaneous adjuncts. This makes a grand total of 97,952, against 90,409 on the 30th of June, 1854—viz., 80,877 in England, 11,403 in Scotland, and 5,672 in Ireland. The length of line open for traffic was 8,116 miles, and the number of stations 2,798. The total number of persons employed on railroads not open, on the 30th of June, 1855, amounted to 38,546, the length of line in course of construction being 879 miles, and the total length authorized 4,481. Of these 38,546 persons, 104 were secretaries, 16 treasurers, 181 engineers, 238 superintendents, 83 storekeepers, 55 accountants, 331 inspectors, 61 draughtsmen, 110 clerks, 601 foremen, 216 policemen, 47 porters, 4,962 artificers, 31,370 labourers, and 171 adjuncts of no special vocation. The total number of persons employed on all railways, open or not, was, on the said 30th of June last, 136,498, against 135,810 in 1854, and of these 104,292 were employed in England, 17,388 in Scotland, and 14,818 in Ireland.

PROVISIONAL PROTECTIONS FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded September 29, 1855.

2170. Henry B. Barlow, Manchester—Improvements in mules and other machines of the like nature, for spinning and doubling cotton and other fibrous materials.—(Communication.)

Recorded October 15.

2301. John Micklethwaite, Leipzig—An improvement in propelling and steering vessels.

Recorded October 16.

2309. William Cotton, Loughborough, Leicestershire—Improvements in the manufacture of looped fabrics.

Recorded October 19.

2343. William A. Gilbee, Paris, and 4 South-street, Finsbury—Improvements in the application of silicate of potash to hardening and preserving stones and calcareous materials.—(Communication.)

Recorded October 24.

2375. James Smith, Liverpool—Improvements in apparatus for giving alarm signals, and for extinguishing fires.

Recorded November 14.

2572. Alfred V. Newton, 66 Chancery-lane—Improvements in the construction of locks.—(Communication.)

Recorded November 15.

2577. George Lister, Leamington—Invention of a cooling apparatus to be used in brewing.

Recorded November 23.

2641. Augustus D. Lacy, Knayton, near Thirsk, Yorkshire—Invention of machinery or apparatus for agricultural purposes, to be used in combination with stationary steam power.

Recorded November 24.

2647. John Elce and George Hammond, Manchester—Invention for the employment of a new material in the manufacture of wicks for moderator lamps.

Recorded November 27.

2672. Edward Peyton and Duncan Morrison, Bordesley Works, Birmingham—Improvements in the construction of metallic bedsteads, and other articles to sit or recline upon.

Recorded November 29.

2695. James E. A. Gwynne, Essex-wharf, Essex-street, Strand—Improvements in instruments for indicating pressure or vacuum.

Recorded December 3.

2717. Frederick Walton, Wolverhampton—An improvement or improvements in papier maché trays.

Recorded December 4.

2725. William Hartcliffe, Salford, Lancashire—Certain improvements in weighting the top rollers of machinery used in preparing and spinning cotton and other fibrous materials.

Recorded December 7.

2765. William I. Ellis, Salford—Certain improvements in the slide valve or valves of steam or other motive-power engines.

Recorded December 10.

2785. Peter Armand le Comte de Fontaine-Moreau, 4 South-street, Finsbury, and Paris—Improvements in obtaining motive power by means of heated compressed air.—(Communication.)

Recorded December 11.

2795. John Horsley, Cheltenham—Invention of certain means of treating quinine and iodine, and other mineral medicines, in order to cause them to combine with cod liver oil, or any other fish oil, or with seed oil.

Recorded December 12.

2805. Robert W. Davis and Daniel Davis, Yellow Springs, Ohio, U.S.—An improved vice.

Recorded December 15.

2836. George Coats, Glasgow—Improvements in horse-shoes, and in attaching the same to horses' feet.
2838. Samuel Twist, Birmingham—Improvements in casters for furniture and other purposes.

Recorded December 22.

2901. James Newman, Birmingham, and William Whittle, Smethwick, Staffordshire—Improvements in the manufacture of hooks and eyes, and in machinery to be employed in the manufacture of the hooks aforesaid.
2903. William Stevenson and William Crawford, Lochwinnoch, Renfrewshire—Improvements in machinery or apparatus for carding or preparing fibrous materials.
2905. Isaac Atkins, New Basford, and Mary Gate and Marmaduke Miller, Nottingham—Improvements in apparatus for measuring and regulating the flow of gas.
2907. William H. Zahn, London—Improvements in windmills or wind engines.
2909. James Chesterman, Sheffield—An improved spring, especially applicable to the joints of knives, razors, scissors, and other like articles.

Recorded December 24.

2911. Sylvain M. Gillet-Oudin, Blois, France—Improvements in making bread.
2913. William Symons, Tavistock, Devonshire—Improvements in the suspension roasting-jack.
2915. George Lean and Robert Thomson, Glasgow—Improvements in weaving.
2917 Richard A. Brooman, 166 Fleet-street—Improvements in treating beetroot and other saccharine vegetable substances, in order to extract alcohol therefrom, and at the same time render or leave the remaining parts of the vegetable fit food for cattle.—(Communication.)

Recorded December 26.

2919. Alexandre Tolhausen, 7 Duke-street, Adelphi—Certain improvements in double-acting pumps.—(Communication from D. W. Clarks, U.S.)
2921. Franck C. Hills, Chemical Works, Deptford—Improvements in economising fuel.
2923. Thomas D. Duppa, Longville, Salop—Improvements in generating and heating steam.—(Communication.)
2925. Charles May and Edward A. Cowper, Great George-street, Westminster—Improvements in combing wool and other fibrous substances, and in machinery for that purpose.

Recorded December 27.

2927. Edward A. Cowper, Great George-street, Westminster—Improvements in combing wool and other fibrous substances, and in machinery for that purpose.
2929. Nicholas Douglass, St. George's-in-the-fields—Improvements in the construction of lighthouses, beacons, piers, and other similar erections.
2931. James E. Cook, Greenock—An improved composition for preserving exposed surfaces, or surfaces liable to deterioration and decay.

Recorded December 28.

2933. Jean J. Robert, 18 Portugal-street, Lincoln's-inn-fields—Invention for the fabrication of torrified beetroot to supersede chicory, as used in coffee, and with a great superiority.
2935. Francis Preston, Manchester—Improvements in the construction of military small-arms.
2937. Paul M. Salomon, Paris—Improvements in the manufacture of gas from peat, and in the coke resulting therefrom, and also in the apparatus connected with that manufacture.
2939. William Rowett, Liverpool—An improved mechanical arrangement for lifting weights, and other useful purposes.
2941. John P. Turner, Birmingham—A new or improved method of shanking metallic buttons, applicable to the heading of nails, and other like purposes.—(Communication.)

Recorded December 29.

2943. Herbert Redfern, Shelton, Staffordshire—Improvements in skates.
2945. John Broadbent and Stanley P. Youle, Manchester—Improvements in machinery or apparatus for cutting out the gores of umbrellas and parasols, which said improvements are also applicable to cutting out forms or shapes for other purposes.
2947. William Brown, Glasgow—Improvements in cooking and culinary vessels and utensils, and in the application and conveyance of heat.
2949. Silvester Lees and Edward Lees, and George H. Newton, Oldham—Certain improvements in machinery for spinning and doubling cotton and other fibrous substances.
2951. William E. Newton, 66 Chancery-lane—An improved process of tanning.—(Communication from Charles C. Knoderez, Strasbourg.)

Recorded December 31.

2952. Sir John S. Lille, C.B., Pall-mall—Improvements in guns, fire-arms, and implements of war connected therewith.
2953. Charles Cowper, 20 Southampton-buildings, Chancery-lane—Improvements in the treatment of coal, and in the purification, desiccation, and agglomeration of coal, and in machinery and apparatus for such purposes.
2955. James Taylor, Britannia Works, Birkenhead—Improvements in apparatus for raising and lowering weights.
2957. James C. Stevenson and John Williamson, South Shields—Improvements in the manufacture of soda and alkali.

Recorded January 1, 1856.

1. Henry Truelove, Liverpool—Improvements in gloves.
3. John Calvert, Strand—Improvements in extracting metals from their ores.
5. William B. Johnson, Manchester—Improvements in steam-boilers and engines.
7. John Thurrell, 32 Castle-street, Oxford-street, Elizabeth M. Muller, 58 Greek-street, Soho, and John R. Chidley, Gresham-street—Improvements in transmitting facsimile copies of writings and drawings by means of electric currents.

Recorded January 2.

8. Andrew Shanks, 6 Robert-street, Adelphi—Certain improvements in machinery for cutting screws.
9. William Bullough, Blackburn—Improvements in machinery or apparatus for sizing yarns.
11. George Hamilton, Great Tower-street—Improvements in apparatus for weighing.

Recorded January 3.

13. Richard Gill, Grove-terrace, Pomeroy-street, New-cross—Improvements in the arrangement and construction of the fire flues and passages of steam boilers, for facilitating and improving the combustion of smoke.
15. Charles Toye, Gloucester-street, Queen-square, Bloomsbury—Improvements in terry fabrics.
17. Joseph W. Schlesinger, Northfleet—Improvements in the mode of using emery, glass, and sand, or other substances, on linen or other material, and in the machinery applicable in the manufacture thereof.
19. James B. Lyall, Castle Frome, Herefordshire—Certain improvements in carriages.
23. Alan Stewart, 85 Regent-street, and Paris—Improvements in measuring the human figure, and in fitting garments thereto.
25. Colin Mather, Salford Iron Works, Manchester, and Charles Millward, Salford—An improvement in steam and vacuum guages.
27. John Fowler, jun., Bristol—Improvements in machinery for giving motion to ploughs and other implements used for cultivating land.

Recorded January 4.

29. Henry B. Barlow, Manchester—Certain improvements in machinery for carding cotton and other fibrous substances.—(Communication.)
31. Charles Hart, Vale of White Horse Iron Works, Wantage, Berkshire—Improvements in portable steam engines, and in apparatus connected therewith, for tilling and cultivating land.
33. Robert Gray, 21 Ridley-place, Newcastle-on-Tyne—Improvements in machinery or apparatus for moulding bricks, tiles, and other similar articles.
35. Thomas Key, Bethnal-green—An improved knife-cleaning machine.
37. Joseph Wright, Burton-upon-Trent—Improvements in furnaces and fire-bars.
39. Joseph Bettelcy, Liverpool—An improvement in the rolling of iron for the making of ships' knees.
41. Robert S. North, Derby, and Ralph Peacock, New Holland, Lincolnshire—Improvements in metallic packings for pistons.
43. William St. T. Clarke, 29 Charing-cross—Improvements in ventilation.

Recorded January 5.

45. Raymond Kammerer, Ostend, and Charles Brewer, Chelsea—Improvements in electric clocks or timekeepers.
47. Henry Hindle, Cavendish-street, Ashton-under-Lyne—Improvements in valves or apparatus for regulating the flow of steam and gas.
49. Louis A. Thérèse, Paris—Certain improvements in harness.

Recorded January 7.

51. Victor Delperdange, 125 Rue Verte, Shaerbeck, Brussels, Belgium—Improvements in metallic and elastic packing.
52. Charles Jarvis and Thomas D. Clare, Birmingham—A new or improved oven or kiln, to be used in the manufacture of coke and pottery, and for heating and drying generally.
53. Samuel C. Lister and William Tongue, Bradford—Improvements in machinery for combing wool, cotton, and other fibrous materials.
54. Thomas Barter, Hart-street—An improved apparatus for administering vapour and douche baths.
55. Richard A. Brooman, 166 Fleet-street—Improvements in machinery for boring and excavating.—(Communication.)
56. Alfred V. Newton, 66 Chancery-lane—An improved mode of manufacturing rods, shafts, and tubes of iron and steel.—(Communication.)

Recorded January 8.

58. Matthias E. Bowra, 63 Basinghall-street—Improvements in the nature and manufacture of waterproof garments and other goods.
60. George B. Locke, Notting-hill, Kensington—Improvements in signalling from trains whilst in motion.
61. Edwin T. Truman, Old Burlington-street—Improvements in artificial palates and teeth.
62. Henry Stuart, Liverpool, and Thomas Pritchard, Runcorn, Chester—Improvements in watches and chronometers, which improvements are also applicable to clocks and other time-pieces.
63. Peter Armand le Comte de Fontains-Moreau, 4 South-street, Finsbury, and Paris—Certain improvements in jacquard machines.—(Communication.)
64. Samuel Middleton, St. George's-row, Southwark—An improvement in the leather-covered rollers used in spinning machinery.

Recorded January 9.

65. John T. Pitman, 67 Gracechurch-street—An improved mode of applying diastase and heat to the saccharification of starch.—(Communication.)
66. George J. C. E. Hald, Manchester—Improvements in the construction of stoves.—(Communication.)
67. Frederick A. Gatty, Accrington, Lancashire—Improvements in the manufacture of lake colours.
68. Victor Jeanne, Adolphe Martin, and Michel E. Martin, Paris—An improved grease-box for axles, journals, and other rotatory parts of machinery.
69. William Barrie, Maida-hill—An improved reflective leveller.—(Communication.)
70. Edward Hallen, Cornwall-road, Lambeth, and William H. Kingston, Bandon, Ireland—Improvements in communicating between the guards and engine-drivers, and between the passengers, guards, and engine-drivers of railway trains.
71. John Ashworth, jun., Turton, Lancashire—Certain improvements in lap machines, or apparatus used in the preparation of cotton and other fibrous substances for spinning.
72. Anker Heegaard, 46 Regent-street—Improvements in making channels or flues.
73. Lambert Alexandre, New York, U.S.—Improvements in propellers for vessels.
74. Charles M. Barker, 25 Kennington-lane, Surrey—An improvement in the pistons of steam-engines.
75. William Watson, Leeds—Improvements in the arrangement of furnaces.
76. Henry Adcock, City-road—An improvement in casting iron and other metal.

Recorded January 10.

77. Martin Billing and Frederick A. Harwood, Birmingham—New or improved machinery for the manufacture of paper bags.
78. John Darlington, 6 Albert-street, Newington, Surrey—Improvements in the manufacture or production of zinc or spelter.
79. John Erskine, Glasgow—Invention for the application of a new material or mixture for dressing or sizeing textile fabrics or materials.
80. Jane A. Herbert, 5 Waterden-place, Guildford—An improved method for extracting the dirt, or the gum, or the colouring matter, or the principle from various vegetable or animal substances and materials.—(Communication.)

Recorded January 11.

81. James Fernihough, Dukinfield, Cheshire—Improvements in steam boilers and apparatus for consuming smoke.
82. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in cards for jacquard mechanism.—(Communication from Gaspard Mesmer, St. Louis, France.)
83. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in railway breaks.—(Communication from Jean B. M. A. Cochot, Paris.)
84. Thomas C. Clarkson, 216 High-street, Wapping—Invention of a combination of certain materials for forming and making improvements in ship and other pumps, tubes, and which is also applicable for ship carriage and other building purposes and parts thereof.
85. Alfred V. Newton, 66 Chancery-lane—A new and improved method of curing meats, preserving provisions, and ventilating and cooling buildings, cars, and vessels.—(Communication.)
86. William Pole, Storey's-gate, Westminster, and Frederick W. Kitson, Leeds—Improvements in railway wheels.
88. William Routledge, Salford—Improvements in cocks or valves for regulating the flow and pressure of steam, water, or other fluids.

Recorded January 12.

89. Alexander Bain, Westbourne Park-road, Paddington—Improvements in the construction of inkstands.
90. Emile C. F. Santelet, Paris—An improved process of tanning.
91. Charles F. L. Oudry, 39 Rue de l'Echiquier, Paris, and 4 South-street, Finsbury—Certain improvements in the preservation of metals and other solid substances.
92. Harry Emanuel, Hanover-square—Improvements in the manufacture of spoons, forks, and other similar articles in metal.—(Communication.)
93. William Owen, Rotherham—Improvements in the manufacture of railway wheels and tyres.
94. Richard K. Day, Plaistow, Essex—Improvements in the manufacture of fuel.
95. Alexander B. Freeland, Manchester—Improvements in the preparation of flour for the purposes of its better preservation and carriage, and in the machinery or apparatus employed therein.

Recorded January 14.

96. Alexandre Tolhausen, 7 Duke-street, Adelphi—Certain improvements in balanced slide valves for steam engines.—(Communication.)
97. William C. Homersham, Caroline Villas, Kentish-town—Improvements in machinery for the preparation of hemp, flax, and other fibrous materials.
98. Adolf Pollak, Vienna, Austria—Invention of a new fusee or cigar light.
99. Adolf Pollak, Vienna—Invention for treating waste oily matters to obtain a product applicable to the manufacture of soap and other useful purposes in the arts.
100. Edward H. Bentall, Heybridge, Essex—An improvement in the construction of machinery for cutting and pulping turnips and other vegetable matters.
101. Nathaniel S. Dodge, 44 St. Paul's Churchyard—Improvements in the preparation or manufacture of leather cloth.
102. Austin Chambers, Canterbury, and William H. Champion, Lynsted, Kent—An improved mode of working railway breaks.
103. John G. Ulrich, 63 Mark-lane—Improvements in chronometers and other timekeepers.
104. Ann E. Malteste, Paris—Improvements in shirts.
105. Abraham G. Brade, Paris—Improvements in recovering the wool from fabrics in which the same exists, together with silk or vegetable textile fibres.
106. William Owen, Rotherham—Improvements in stoves and fire-places.

Recorded January 15.

107. Pierre T. A. Nicouland, 39 Rue de l'Echiquier, Paris, and 4 South-street, Finsbury—Improvements in steam boiler furnaces.—(Communication.)
108. Joseph H. T. I. B. Hostage and John Tatlock, Chester—Improvements in railway chairs.
109. Samuel Sheppard, Birmingham—Invention of a new or improved tap or stop-cock.
110. Thomas H. Bakewell, Welford-road, Leicester—Improvements in ventilating, warming, and cooling rooms and other places.

Recorded January 16.

112. Henry M'Evoy, Hall-street Works, Birmingham—Improvements in locks, latches, and staples.
113. Henry Law, 15 Essex-street, Strand—Improvements in heaving up slips for the repair or construction of ships or other vessels, and for a continuous-action purchase for the same, which is also applicable to other purposes.
114. William Pranglcy, Salisbury—Invention of a novel instrument for exercising the third finger, and thereby facilitating the playing upon musical instruments.
115. Vincent Scully and Bennett Heywood, Dublin—Improvements in the construction of inkstands, applicable in part to other vessels for the reception of fluids.
116. John Abraham, Birmingham—New or improved machinery for the manufacture of percussion caps, and for cutting out and raising articles in metal generally.
117. John Hamilton, jun., Liverpool—Improvements in the posts or uprights employed in constructing electric telegraphs.
118. Johnson Thompson, Sunderland—Improvements in ships' keelsons.
119. John Hamilton, jun., Liverpool—Improvements in constructing the permanent ways of railways.
120. John Fowler, jun., Bristol—Improvements in machinery for ploughing land.
121. David Dring, 149 Great Dover-road—Improvements in machinery for cutting wood pegs.—(Communication.)

Recorded January 17.

123. Peter Armand le Comte de Fontaine-Moreau, 4 South-street, Finsbury, and Paris—An improved apparatus for the prevention of accidents or collisions on railways.—(Communication.)
124. Alexandre Tolhausen, No. 7 Duke-street, Adelphi—An improved gas-meter.—(Communication.)
125. Philipp Rechten, Bremen—Invention for the taking of whales and other cetaceous fish by means of a harpoon, constructed on entire new principles.
127. James Jackson, Manchester—An improved apparatus for retaining and releasing cords of "Venetian blinds," or cords, bands, or chains, employed for other purposes.
128. Oliver Philcox, 30 Willes-road, Kentish-town, St. Pancras—Invention for increasing

the effect and the facility in fingering the pianoforte, organ, or other musical instrument having a keyboard.
129. William Chapman, Sunderland—An improvement in propelling vessels.
130. Joseph J. Comstock, Liverpool—Improvements in generating steam.—(Communication.)
132. William W. Squires, Liverpool—Improvements in preventing the bursting of pipes and tubes for conveying liquids.

Recorded January 18.

133. Ginseppe A. Tremeschini, Vicence (Lombardo-Venetian)—Improvements in electro-telegraphic communications.
134. Joseph Moseley, Well-walk, Hampstead—Invention for the transport of all goods, merchandise, and valuable commodities whatsoever.
135. Miguel de Bergue, Barcelona—Improvements in the permanent way of railways.
136. Joseph Schloss, Wellington Chambers, Cannon-street West—Invention of a piston bolt, or certain improvements in fastening travelling-bags, portmonnaies, cigar cases, writing-desks, drawers, doors, and similar objects where locks, bolts, or clasps are employed.
137. William Marshall, Smethwick, Staffordshire—An improvement or improvements in rolling iron for the manufacture of gun-barrels and tubes, and for other like purposes.
138. Henry G. Rule, Manchester—Certain improvements in machinery or apparatus for measuring water or other fluids.
139. David Sbaw, Gee Cross, Cbesbire—Certain improvements in looms for weaving.
140. Edward Myers, Rotherbam—Improvements in buffers and other springs for railway and other carriages.
141. Nathaniel S. Dodge, St. Paul's Churchyard—Improvements in treating vulcanized india-rubber or gutta percha.—(Communication.)
142. François J. Manceaux, Paris—Improvements in fire-arms.
143. Jonathan Holden, Halifax—Improvements in machinery for cutting or carving and figuring wood.
144. Charles W. Harrison, Woolwich—Improvements in transmitting communications, and in the apparatus employed therein.
145. Joseph Marzolo, Paris—Invention of "a reproductive organ," printing with known notes any musical fancies, and equally applicable to piano-fortes, melodiums, harmoniums, accordions, and generally to all keyed musical instruments.
146. James Buckley, Oldham—Improvements in looms for weaving.

Recorded January 19.

147. Alfred Heaven and William Booth, Manchester—Improvements in machinery for embroidering fabrics.
148. Alfred Dawson, 14 Barnes-place, Mile-end-road, Stepney—Invention of an apparatus for converting small coals or coal dust, or small coals and coke, or coal dust and coke, with the admixture of water or other materials, into solid blocks of fuel, parts of which apparatus can be used and are suited for other purposes.
149. Edward Pickering, Cbatham-place, Blackfriars—Improvements in the permanent way of railways.
150. John Armour, Kirkton Bleach Works, Renfrewshire—Improvements in bleaching, washing, or cleansing textile fabrics and materials.
151. Isaac Barnes, Birmingham—Improvements in carriage lamps.
152. Thomas Horsfall, Deptford, and William Turnbull, Rotherhithe—Improved machinery for breaking and preparing hemp, flax, and other similar vegetable fibres.
153. Frederick Ayckbourn, 10 Princes-street, Stamford-street, Surrey—Improvements in the cleaning of knives and forks.
154. Herman J. Van den Hout and Ebenezer Brown, Kentish-town—Improvements in the preparation of pulp for the manufacture of paper, millboard, and other like purposes.
155. Charles Robertson, 68 Mark-lane—Improvements in mariners' compasses.

Recorded January 21.

156. Samnel Fenton, Wavertree, Lancasbire—Certain improvements in locks and fastenings.
158. John Gedge, 4 Wellington-street South, Strand—Improvements in the manufacture of boots or shoes.—(Communication.)
159. James Pockson, Penton-street, Walworth, Surrey—Improvements in the construction of roofing and other tiles.

Recorded January 22.

162. Pierre L. Tieffé-Lacroix, Metz, France—Improvements in machinery for cutting files.
163. Jean B. P. A. Thierry, jun., Jean L. Richard, Paris, and Baron Henry de Martiny, Versailles, France—Improvements in preventing smoke by means of a fumivore hygienic apparatus.
164. John Gedge, 4 Wellington-street South, Strand—Improvements in wrought-iron wheels.—(Communication.)
165. John Gedge, 4 Wellington-street South, Strand—Improvements in bending, edging, and soldering tin.—(Communication from M. Blanchefort, Briey, France.)
166. Peter Armand le Comte de Fontaine-Moreau, 4 South-street, Finsbury, and Paris—Certain improvements in machinery or apparatus for manufacturing nails.—(Communication.)
167. Alexander Robertson, Upper Holloway—Invention of a new manufacture of cases or canistera for dry goods, edibles, and such like commodities.
168. Thomas Hitt, Tavistock-street—Invention of certain arrangements of machinery for converting reciprocating into rotary motion.
169. Edward Lawson and George Jennings, Leeds—Improvements in reeling machines for winding flax, cotton, and other yarns.
171. Joseph Francis, New York—Improvements in the manufacture of metallic boats.
172. John Beech and Edward Jeffreys, Sbrewsbury—Improvements in the means of supporting the rails of railways.
173. Henry E. Hoole, Green-lane Works, Sheffield—Improvements in stove grates.

Recorded January 23.

174. John Onions, Wellington-place, Blackfriars-road, Southwark—Improvements in the manufacture of iron.
175. George Holcroft, Manchester, and James Peacock, Salford—Improvements in casings for fencing horizontal shafts.
176. Alexandre Tolhausen, 7 Duke-street, Adelphi—An improved manufacture of yarn from wool or other felting material.—(Communication.)
177. Alexandre Tolhausen, 7 Duke-street, Adelphi—An improved lock joint for the rails of railways.—(Communication from James R. Hilliard, U.S.)
178. William Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in the treatment and application of fatty, resinous, and gummy substances, and in the manufacture of pastes, greases, and soaps.—(Communication.)
179. Edward Lloyd, Dee Valley, near Corwen, Merionethshire—Improvements in valves, and in the valve-gear of locomotive and other steam-engines.
180. Johannes J. M. Meyer, Bartlett's-buildings—An improved mode of manufacturing bank notes, cheques, and other like documents.
182. Archibald Turner, Leicester—Improvements in the manufacture of elastic fabrics.
183. Isaac Barnes, Birmingham—Improvements in the manufacture of knobs and furniture for doors, drawers, and other similar purposes, parts of which improvements are also applicable to the manufacture of cornice poles and other like articles.
184. James Newman, Birmingham, and William Whittle, Smethwick—Improvements in the manufacture of shafting for mill and engine purposes, which improvements are also applicable to the manufacture of shafts, poles, beams, masts, spars, and other similar articles, in which great strength or lightness, or both these qualities combined, may be requisite,
185. Stephen Norris, New Peter-street, Westminster—Improvements in the manufacture of boots and shoes, and other coverings for the human feet.

Recorded January 24.

186. Louis A. R. Richoux, Paris—Improvements in clock works.
187. Pierre Samain, Meusnes (Loire et Cher), France—An improved levelling instrument.
188. John Solmans and Edwin Lander, Birmingham—A new or improved cigar-holder.
189. Charles Rothwell, Staleybridge, Cheshire—Improvements in self-acting mules.
190. John Strafford, Stratford, Essex—Certain improvements in portable signal lamps for railway, marine, and other purposes.
191. John Gimson and George Gimson, Staleybridge, Lancashire—An improved apparatus applicable to steam pipes used for the purposes of heating and drying, which said apparatus may also be used for other similar purposes where steam is employed.
192. John H. Johnson, Lincoln's-inn-fields, and Glasgow—Improvements in air beds, mattresses, and cushions.—(Communication from Jean C. L. Jacob, Paris.)
193. George B. Pettit and Henry F. Smith, Oxford-street—Improvements in gas-heating apparatus.
194. David Fisher, 12 Ranelagh-road, Thames-bank—Improvements for machinery for pressing, cutting, drying, and opening tobacco.

Recorded January 25.

196. Alexandre Tolhausen, 7 Duke-street, Adelphi—An improved machine for boring and other cutting operations in stone and other mineral substances of similar character.—(Communication.)
198. Andrew Shanks, 6 Robert-street, Adelphi, and Francis H. Wenbam, Effra Vale Lodge, Brixton—Certain improvements in water guages.
200. John Kershaw, Stockport, Cheshire—Improvements in apparatus for preventing the explosion of steam boilers.
202. Joseph Peak, Manchester—Improvements in machinery or apparatus for pointing and turning bolt-heads, facing nuts, centering, drilling, and similar purposes.
204. Alexander Dalgety, 76 Florence-road, Deptford, Kent—Improvements in vices, or gripping or holding apparatus.
206. William Owen, Red Lion-square—An improvement in piano-fortes.
207. Alexis J. Dessales, Paris, and 43 Southampton-buildings, Chancery-lane—Improvements in oil lamps and in reflectors for the same for railway carriages and other purposes.

Recorded January 26.

208. George H. Ingall, Old Broad-street, London, and George O. S. Browne, Glasshouse-street, Nottingham—An improved method of railway signalling.
209. Alexander Dalgety, 76 Florence-road, Deptford—An improved self-acting stand or stilt for casks or barrels.
210. George Napier, Bath-street, Glasgow, and Adelphi, Middlesex—Improvements in the construction and arrangement of the flues, air passages, and other parts of furnaces, and also in controlling the passage of smoke, and in heating and regulating the supply of air to facilitate combustion.
211. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in compressed air locomotive engines.—(Communication from Jean P. L. F. Datichy, Paris.)
212. Edward V. Gardner, 24 Norfolk-street, Middlesex Hospital—Improvements in heating, drying, desiccating, and evaporating.
213. Patrick Doran, 10 Cornwallis-street, Liverpool—Improvements in pneumatic apparatus for raising sunken vessels or other bodies under water, and for keeping afloat vessels or other bodies liable to sink.
214. Jean L. A. Huillard, Paris—Improvements in the processes of singeing and dressing textile fabrics, and in apparatus for the same.
215. William Spurrier, Birmingham—A new or improved method of attaching handles to metallic teapots and other vessels, which method of attachment may also be applied to the fixing of castors on furniture and other like purposes.
216. Samuel Statham, Islington—Improvements in electric telegraph conductors.
217. William Dreschfeld, Manchester—An improvement in, or addition to, rollers employed in spinning.
218. William Beasley, Smethwick, Staffordshire—Improvements in machinery or apparatus to be employed in rifling the barrels of fire-arms and ordnance.
219. Alexander J. Walker, New York, and William Bennett, Brooklyn, U.S.—An improved method of forming hat bodies or other felted articles.

Recorded January 28.

220. Abram Longbottom, 41 Moorgate-street, and William Longmaid, Victoria Cottage, Stoke Newington—Improvements in apparatus for generating and heating steam.
221. Peter Brown and George Brown, Liverpool—Improvements in the method of cleaning, dressing, and preparing a certain description of seed or grain, called "dari," and frequently called "millet," and thereby rendering the same suitable for food.
222. John Wormald, Manchester—Certain improvements in machinery or apparatus for folding, "fenting," and making up goods or fabrics.
224. Augustin M. Jullienne, Herblay (Seine et Oise), France—Improvements in brakes for railway trains.
225. Jean B. J. Hyppolite d'Auvergne, Blois, France—Improvements in portable writing or drawing desks.
226. Pierre Samain, Mensnes (Loire et Cher), France—Improvements in tables, stools, and other pieces of household furniture.
227. Pierre E. Guérinot, Rue au Maire, Paris—Invention of stopping instantaneously two railway trains running against each other.
228. Robert Barrow, 32 Garford-street, Poplar—An equilibrium slide valve for steam-engines.
229. Samuel J. Goode, Aston, near Birmingham—A new or improved gas stove.
230. William Ashbury, Birmingham—A new or improved tap or stop-cock.
231. Jean H. Destibeaux, Paris—An improved waterproof fabric.
232. John Whitehead, Leeds—Improved machinery for fulling cloth.—(Communication.)
233. Henry S. King, Cornhill—Improved apparatus for printing and embossing.—(Communication.)

Recorded January 29.

234. George Darlington, Minera, near Wrexbam, Denbighshire—Invention for producing oxide of zinc from its ores.
235. William J. Simons, Royston, Herts—An improved governor for steam and other engines requiring governors.
236. Daniel Foxwell, Manchester—Improvements in sewing machines.

237. William H. Lancaster and James Smith, Liverpool—Improved arrangements for the application of gas and atmospheric air to the generation of heat in furnace or other flues, and the consumption of smoke.
238. Robert Thatcher, Oldham—Certain improvements in preparing for doubling or spinning cotton or other fibrous substances.
239 James Fleming and George Fyfe, Glasgow—Invention for the consumption of smoke in engine and other fires.
240. Owen Murrell, Bethnal-green-road—Improvements in swing looking-glasses.
241. William Fowler and William M'Collin, Kingston-upon-Hull—An improved thrashing machine.
242. Henry Chance, Birmingham—An improvement in the manufacture of moulded articles when using vitreous materials.
243. Samuel P. Gladstone, Lea Cottage, Orchard House, Poplar—Improvements in the construction of masts and yards.
244. Joseph F. Walton, Sarratt Hall, Rickmansworth, Herts, and Honore Le François, Lambeth, Surrey—Improvements in cleaning forks, spoons, stewpans, and other culinary utensils.
245. Abraham Pope, Edgware-road—Improvements in the manufacture of iron, copper, tin, and lead.
246. Auguste M. M. de Bergevin, 27 Rue Labat, Montmartre, Paris—Improvements in preparing coal for burning, and in the furnaces employed in consuming such coal.

Recorded January 30.

247. Robert W. Winfield, Birmingham—An improvement or improvements in the manufacture of metallic bedsteads and other articles of metallic furniture.
248. John H. Walsh, Portland-place, Clapham-road—Improvements in omnibuses.
249. John Toward, Glasshouse Bridge Iron Works, Newcastle-upon-Tyne—Improvements in iron shipbuilding and in iron plates therefor, which plates are also applicable to other purposes where great strength is required.
250. Charles F. Claus, Latchford, Cheshire—Improvements in the preparation of hides or skins, also applicable to the preparation of the entrails of animals.
251. Alfred V. Newton, 66 Chancery-lane—An improvement in the manufacture of cannon.—(Communication.)
252. William Gossage, Widnes, Lancashire—Improvements in the manufacture of certain kinds of soap.
253. Thomas F. Wilkinson, 25 Bloomsbury-street, Bedford-square—Improvements in reaping and mowing machines.
254. John L. Stevens, London—Improvements in doors or apparatus for regulating the supply of air to steam boiler and other flues and furnaces.
255. Johu Gretton, Burton-upon-Trent—Improvements in brewing.

Recorded January 31.

256. John Stokes, Birmingham—An improvement or improvements in fog signals.
257. Henry Holford and Mark Mason, Newton Iron Works, Hyde—Improvements in machinery or apparatus for compressing metals and for manufacturing all kinds of metallic rivets, bolts, or similar articles.
258. Aubin Emile-Coullard-Descos, Paris—Improvements in consuming smoke.
259. James Mash, Manchester—Improvements in working the valves of steam engines.
260. George Napier, Bath-street, Glasgow, and of the Adelphi—Improvements in apparatus for raising, lowering, and suspending boats from ships.
261. Henry Tylor, New Bond-street—An improved joint, applicable to cots, bedsteads, and other frames in metal.
262. John Kinniburgh, Renfrew—Improvements in moulding or shaping metals.
263. Joseph Harrison and John Oddie, Blackburn—Improvements in machines for winding yarn or thread on to spools or bobbins.
264. Thomas B. Turton and John Root, Sheaf and Spring Works, Sheffield—Improvements in buffer, bearing, and draw springs.
265. Henry Render, Manchester—A new or improved lubricating material.
266. Frederick Kersey, 5 Laurie-terrace, St. George's-road, Southwark—An improvement in the manufacture of drain pipes.
267. George H. Cottam and Henry R. Cottam, Old St. Pancras-road—Improvements in folding bedsteads and chairs.
268. John B. Anderson, East-hill, Wandsworth—Improvements in the manufacture of soap, parts of which improvements are applicable to preparing materials for the purposes of illumination, and also for the purposes of lubrication.
269. Thomas Hurst, Tanner-street, Barking, Essex—Improvements in the connecting of the rails or "metals" generally used on railways.
270. John H. Johnson, 47 Lincoln's-inn-fields, and Glasgow—Improvements in gas-burners and in regulating the combustion of gas.—(Communication from Pierre A. Maunoury, Paris.)

Recorded February 1.

272. Matthew Ker, 8 Cumberland-market, St. Pancras—Invention of a machine for sweeping carpeted and other floors.
274. Francis Preston, Manchester—Improvements in machinery for shaping and rolling metal.
276. Charles R. Moate, 65 Old Broad-street—An improvement in securing and sustaining the rails of railways.
278. William Dray, King William-street—An improved cartridge-box and pouch.
280. Francis B. Fawcett, Kidderminster—Improvements in the manufacture of carpets.
282. George N. Hooper and William Hooper, Haymarket—Improvements in springs for carriages, and for the cushions of carriages, chairs, mattresses, beds, and other similar articles.
284. George Duckett, 5 Norfolk-terrace, Westbourne-grove West, Bayswater—Improvements in carts and vans.
286. Charles C. Joubert, Rue de Moscow, and Leon A. Bordier, Rue de la Ferme des Mathurins, Paris—Improvements in motive power engines.
288. John O'M. Beamish, Trafalgar-road, Old Kent-road—An improvement in the manufacture of morocco leather.

Recorded February 2.

290. John R. Day, Birmingham—A new and improved lock and door latch.
292. Benjamin Burleigh, Great Northern Railway, King's-cross—Improvements in certain parts of the permanent way of railways.
294. William Goodmau, 6 Canning-place, Leicester—Improvements in machinery for producing knit or looped fabrics.

Recorded February 4.

298. Ralph Waller, Manchester—Improvements in preparing cotton and other fibrous materials.
302. Mathew Whiting, jun., Manning-street, Bermondsey—Improvements in preparing for and in tanning hides and skins.
304. Nathan Ager, Upper Ebury-street, Pimlico—Improvements in connecting spindles of locks and latches with their knobs and handles.
306. Thomas Mills, Leicester—Improvements in machinery for the manufacture of looped fabrics.

Recorded February 5.

308. Frans V. O. Hyckert, Paris—Improvements in heating.
310. Michael L. Parnell, 283 Strand—An improvement in the construction of locks.
312. Francis M. Jennings, Cork—Improvements in bleaching vegetable fibres.
316. Thomas Williams, Clerkenwell—Improvements in omnibuses.

Recorded February 6.

318. George Napier, Bath-street, Glasgow, and of the Adelphi, and John Miller, Cavendish-street, Glasgow—Improvements in the mode of driving and in applying screw propellers to the propulsion of vessels.
320. John Dodgeon, Burnley, and James W. Bateson, Rawtenstall, Lancashire—Certain improvements in looms for weaving.
322. John Inshaw, Birmingham—A new or improved pressure guage.
324. Charles Victor de Sauty, St. Mary's-terrace, Walworth—Invention for the prevention of the loading or fouling of fire-arms.
326. Franklin Prestage, Wylye, Heytesbury, Wiltshire—Improvements in locomotive engines.
328. Charles F. P. Funcke, Herdecke, Westphalia—Improvements in tanning skins and hides.

Recorded February 7.

330. Richard Bleasdale, Rochdale—Certain improvements in the machines for spinning, called throstles.
334. Henry Berlette, Boulogne-sur-Mer, France—An improved apparatus for roasting coffee.

☞ *Information as to any of these applications, and their progress, may be had on application to the Editor of this Journal.*

DESIGNS FOR ARTICLES OF UTILITY.

Registered from Nov. 22d to Feb. 7th.

Nov. 22d,	3786	Key & Co., Charing-cross,—"Solocornu."
26th,	3787	J. Jones & Son, Bow-street,—"Gas torch."
27th,	3788	F. Jackson, Derby,—"Office almanack."
—	3789	A. J. Melhuish, Blackheath,—"Part of a camera."
28th,	3790	Turner & Pegg, Leicester,—"Clasp-fastening."
Dec. 5th,	3791	G. Gledhill, Huddersfield,—"Wind-guard."
6th,	3792	G. Grout, Tottenham,—"Cotton armlet."
—	3793	R. D. Charles, Bristol,—"Pair of trousers."
10th,	3794	D. W. & T. Bentley, Margate,—"Potato-steamer."
12th,	3795	G. A. Chambers, Finsbury,—"Perambulator."
15th,	3796	E. Israel, St. Mary-axe,—"Flower-pot."
17th,	3797	A. Grant Brothers, Wood-street,—"Volkommon shirt."
21st,	3798	Page & Gurliug, Melton, Suffolk,—"Vegetable cutter."
31st,	3799	James Clifton, New Oxford-street,—"Fore-carriage for perambulators."
1856.		
Jan. 1st,	3800	T. P. Hawkins, Birmingham,—"Chain."
3d,	3801	J. Jobson, Litchurch Works, Derby,—"Stove-joints
—	3802	E. Davis, Albion-street, Leeds,—"Pressure-gauge."
16th,	3803	R. Frost, Wilson-street, Gray's-inn-road,—"Screw-barrel tilt."
21st,	3804	R. Besley & Co., Fann-street, Aldersgate-street,—"Composing-stick."
Feb. 1st,	3807	Smith, Kemp, & Wright, Birmingham,—"Clasp for belts and other articles of dress."
2d,	3808	Price's Patent Candle Company, Belmont, Vauxhall,—"Lamp for omnibuses and other carriages."
7th,	3809	Thomas & Charles Clark, Wolverhampton,—"Improved sash-frame guide-pulley."

DESIGNS FOR ARTICLES OF UTILITY.

Provisionally Registered.

Nov. 28th,	715	J. & Foxeland, Hackney-wick,—"Cigar box."
—	716	O. Palmer, Oxford-street,—"Buckle strap."
29th,	717	W. F. Taylor, Windsor,—"Ladder-shop stool."
Dec. 4th,	718	Lieut. P. Harris, Chatham,—"Service canteen."
5th,	719	R. Sbinkwin, Kennington,—"Flue retort."
—	720	R. Frost, Gray's-inn-road,—"Nursery-chaise stand."
—	721	T. R. Grimes & Co., New Bond-street,—"Carriage lamp."
6th,	722	R. Mabbs, Islington High-street,—"Milk refrigerator."
8th,	723	J. Winter, Hackney,—"A corbel for walls."
10th,	724	T. Spratt, Kennington,—"Flexible union joint."
11th,	725	J. Hill, Piccadilly,—"Army bucket."
12th,	726	Millward & Fiddian, Birmingham,—"Tea-pot."
13th,	727	R. S. Thorn, Basinghall-street,—"Book-rounder."
14th,	728	G. Hodges, Dublin,—"Swivel-bridge."
15th,	729	W. F. Taylor, Windsor,—"Music book-stand."
19th,	730	B. Wilson, Bow-lane,—"Felt banded hat.'
21st,	731	T. Wells, Ware, Herts,—"Gauge-guard."
—	732	W. G. Gard, Tavistock,—"Ruler."
28th,	733	T. Pinder, Nottingham,—"Spring for lace-making carriages."
1856.		
Jan. 12th,	734	G. Lindsey, Stoke Newington,—"Gold pen hall-marked."
14th,	735	F. Wilkins, Harley-street,—"Street tramway."
21st,	736	W. H. Bowers, East-road, City-road,—"Railway buffer."
23d,	737	T. Morris, Regent-street,—"Valve and air regulator for common stoves."

TO READERS AND CORRESPONDENTS.

Enlargement of the "Practical Mechanic's Journal."—In future, the Monthly Parts of this *Journal* will consist of twenty-eight quarto pages, being an increase of four pages upon the present size. This addition to its size will be without any increase in price, and it will enable us to largely enhance the value of the work in its especial features as a book of reference for the Inventor and the Patentee, and all connected remotely or nearly with industrial and scientific pursuits.

Completion of the Eighth Volume of the "Practical Mechanic's Journal."—The present Part, No. 96, completes the 8th volume of this *Journal*, and the entire set of volumes may be had from any bookseller, in cloth, lettered in gold, price 14s. each; or the whole 96 Parts may be purchased, as originally published, at 1s. each. The eight volumes may also be had, handsomely bound in half calf, in four double volumes, with the Plates bound separately to correspond. Price 31s. 6d. for each double volume and volume of Plates. Vol. 8 contains 27 quarto pages of Copperplate Engravings and 500 Engravings on Wood, with 296 pages of Letterpress.

J. T. Chesterfield.—See Mr. Wilson's little volume on the "Stearic Candle Manufacture," published by Bogue, Fleet Street. Much depends on the ultimate application of the fatty matter. Ure's Dictionary will, however, give general information on the subject.

J. W.—There is nothing novel in the idea of either of them, but the details are different. His other remarks have some truth in them, but they are too sweeping.

THE

PRACTICAL MECHANIC'S JOURNAL

ILLUSTRATED INDEX.

VOLUMES I. TO VIII.

"Les inventions des hommes vont en avancent de siecle en siècle."—*Pascal.*

"Let science bear witness how many of her brightest discoveries have been struck out by the collision of analogy, and by original minds bringing one part of their information to consult and co-operate with another."—*Thomas Campbell, the poet.*

The number, variety, and magnitude of our manufacturing establishments; the quantity, complication, and nicety of our machinery; the extent of our shipping and inland steam locomotion; all these declare a people who are determined to be at the head of producers and sellers, so long as consumers and purchasers can be found. In what corner of the globe are we not seen buying or selling? Where is it that we are not found collecting luxuries for home consumption, and tendering the products of our own industry in exchange? There is no such spot, for we export and import to and from every quarter. Now it is quite clear that, unless we have the power of creating gold, and coining it at our own will, we must sell to buy, and buy to sell. We cannot go empty-handed to foreign countries. We must either offer money or money's worth for their cotton, their sugars, their timbers, and their wines, or we do not get them at all. Precisely, then, in proportion to the extent of our commerce must be the extent of our manufactures. Both are so completely dependent on each other, that whatever affects the one acts on the other. The larger and closer is the network of commerce, the greater is the activity infused into manufactures; and as demand governs supply, there is a blight upon home industry the moment anything goes wrong abroad. Now, the right arm of manufactures is machinery, for without the aid of machinery, not even what we require in our own country could be supplied, and many articles now considered necessaries of existence would never have had being, or would be confined entirely to the wealthy classes. But by machinery we abridge labour, and thus produce in large quantities and at less cost. With this help, we can manufacture at a rate adequate to any amount of demand, and with an immense saving of expense; and thus we are able to sell goods at a much cheaper rate than we could otherwise possibly do. By manufacturing on a large scale, and selling cheap, the British producer gains two ends. He keeps possession of the foreign market against foreign rivals, and he extends his home market. The public are ever ready to adopt conveniences, and indulge in luxuries. We have only to remove the bar of expense, and a demand instantly arises, which increases as the price is lowered. Thus it is the policy of the producer to sell cheap, in order that he may sell much. But there is another reason why the manufacturer lowers prices, and that is competition. There are rivals in the market, and abroad a very formidable one—the local producer. It is the inevitable tendency of all successful enterprise to engender rivalry, and then there is a keen struggle to *make* cheaper, with a view to *sell* cheaper. The engineer and machinist are again called into counsel, and their powers of invention are taxed for new means of further abridging labour. Thus the natural desire of improving is stimulated into livelier activity, both by the expectation of an extended market, and by competition; and thus, all existing combinations are perpetually undergoing review, new contrivances and applications are sought out, old forms and elements are re-arranged, and the whole domain of mechanical science is receiving diligent scrutiny and culture, with a view to improve and perfect.

The utility of a journal which records the progress and development of the mechanical arts and sciences, registers deserving inventions and improvements in machinery and engineering, and chronicles facts connected with these important branches of human industry, must, we think, be admitted by all. If properly conducted, such a publication ought to be of advantage to the manufacturer and workman—the inventor and the student.

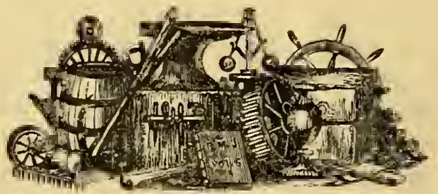
To the manufacturer it will give information as to the improvements which are continually being introduced into the arts and manufactures at home and abroad; a knowledge of which is absolutely necessary in order to keep pace with the requirements of the times, and to compete successfully with rival producers.

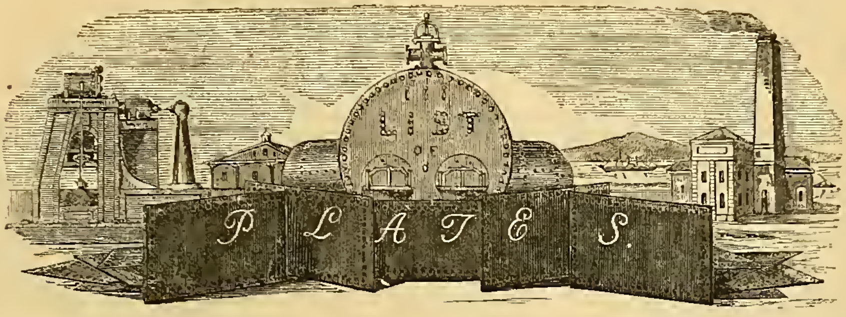
It will assist the workman and student with explanations on questions of principles and details; it will yield parallel applications of the one, and new illustrations of the other; and will put all readers on a level with the discoveries of the age.

The inventor will have the means of making the fruits of his labour known to the public, and thus of reaping a reward proportionate to the merit of his invention.

Finally, the public derives benefit from discoveries in mechanical art, for sooner or later they result in the increased cheapness and plenty of the article manufactured, be it bread, cloth, or metal, and this is the "be-all" and the "end-all" of all our labours.

With the view of opening a communication between the class of inventors and the body of manufacturers, of assisting the education of the student, and of disseminating through the community a knowledge of the latest improvements, the PRACTICAL MECHANIC'S JOURNAL was set on foot more than eight years ago. During that period, the Editors have exerted their best endeavours to bring forward the most useful discoveries in Mechanics, Engineering, and the Practical Sciences, and they are happy to say that their exertions have not been unappreciated by the public. They hope to be excused entertaining feelings of pride when they refer to the thousands of engravings, illustrating the progress of the useful arts, which they have laid before the world, and they promise that, as long as this Journal is under their management, they will not relax their efforts to make it worthy of public support, and an aid to the leading feature of the times—PROGRESS.





These Engravings being all executed from elaborately finished drawings, made by our own draughtsmen, under the Editor's personal superintendence, either directly from the machinery, or from the working drawings of the engineers, are of undoubted accuracy and completeness, and will be found of great use in the workshop.

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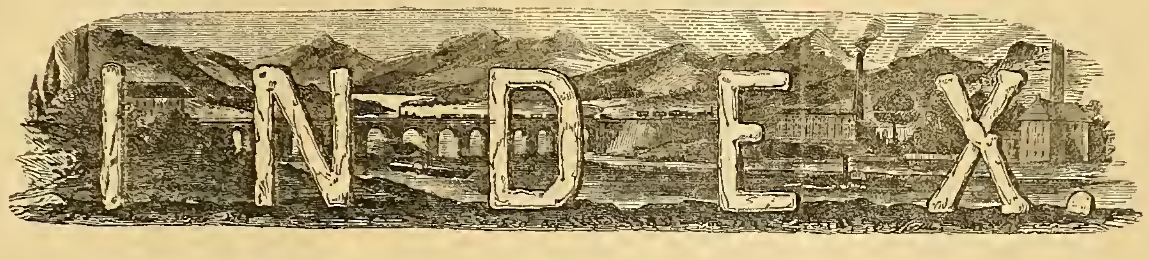

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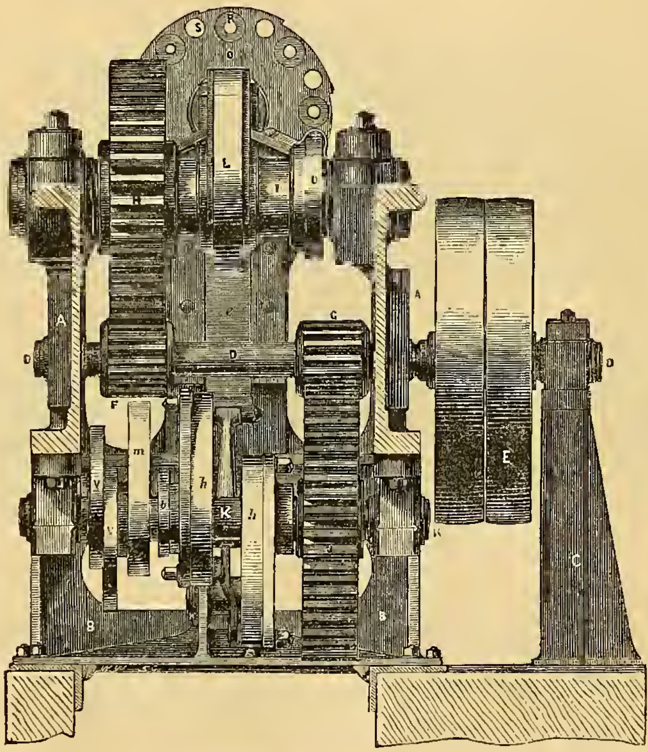

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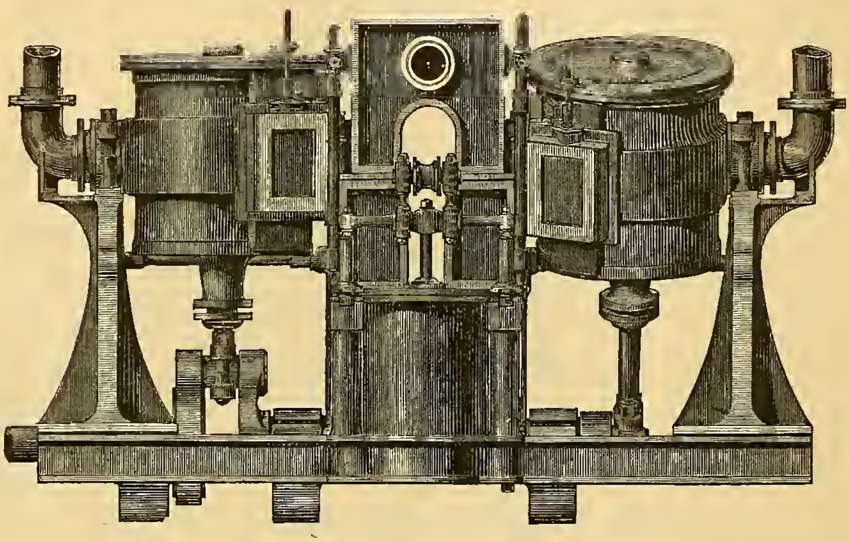

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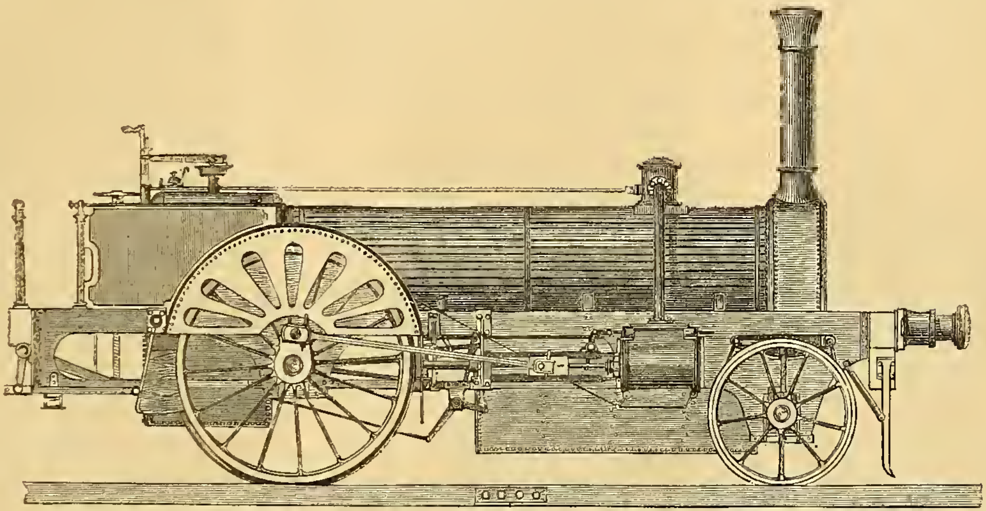

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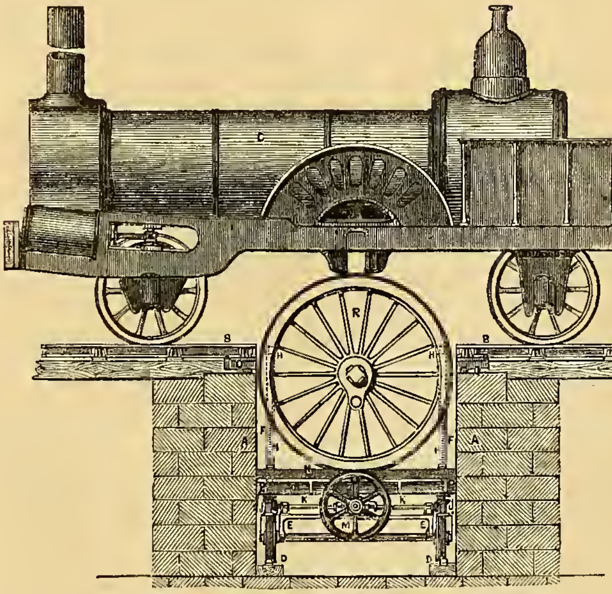

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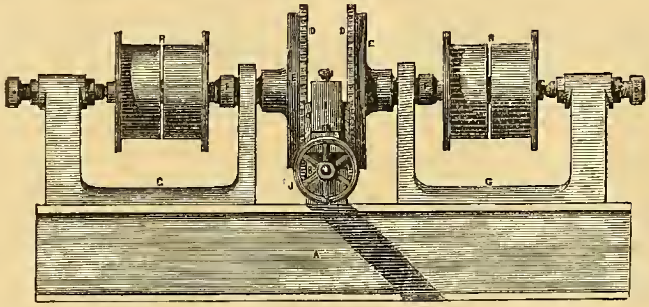

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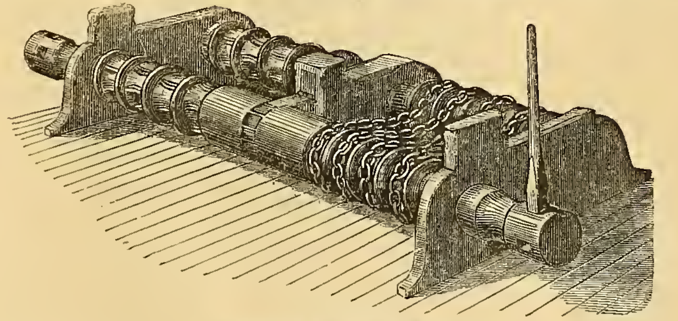

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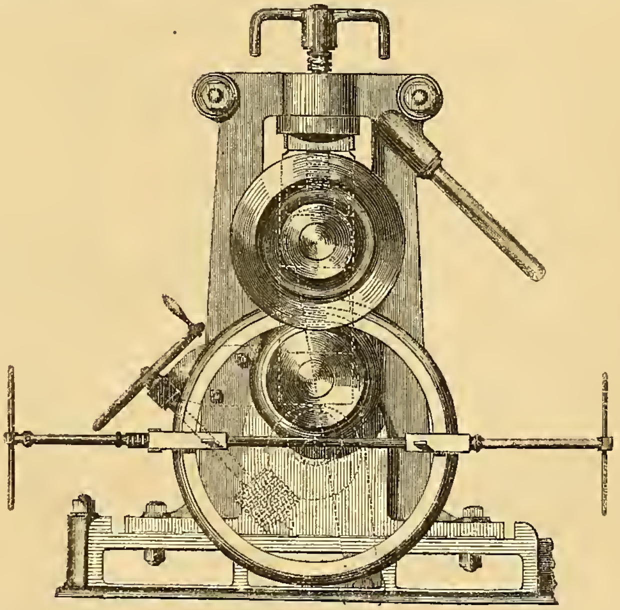

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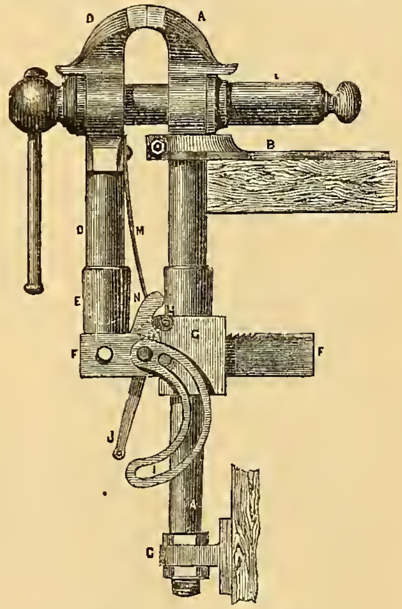

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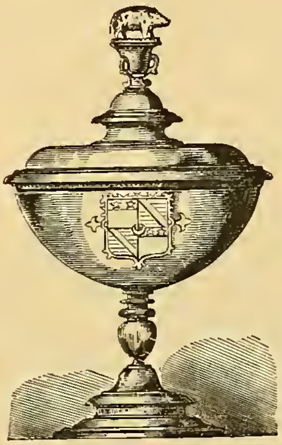

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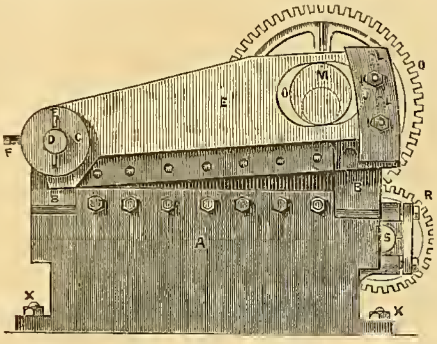

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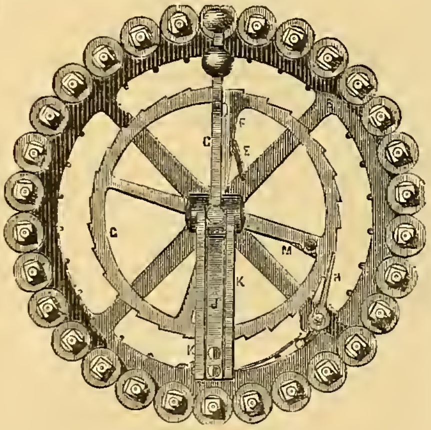

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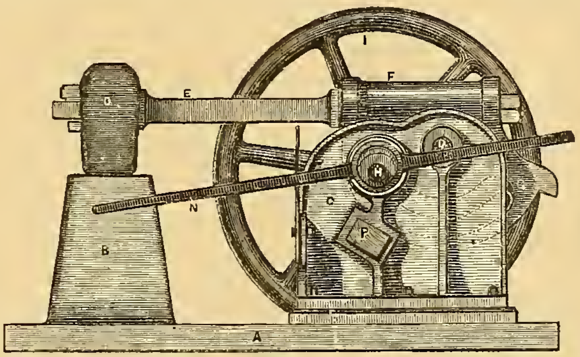

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